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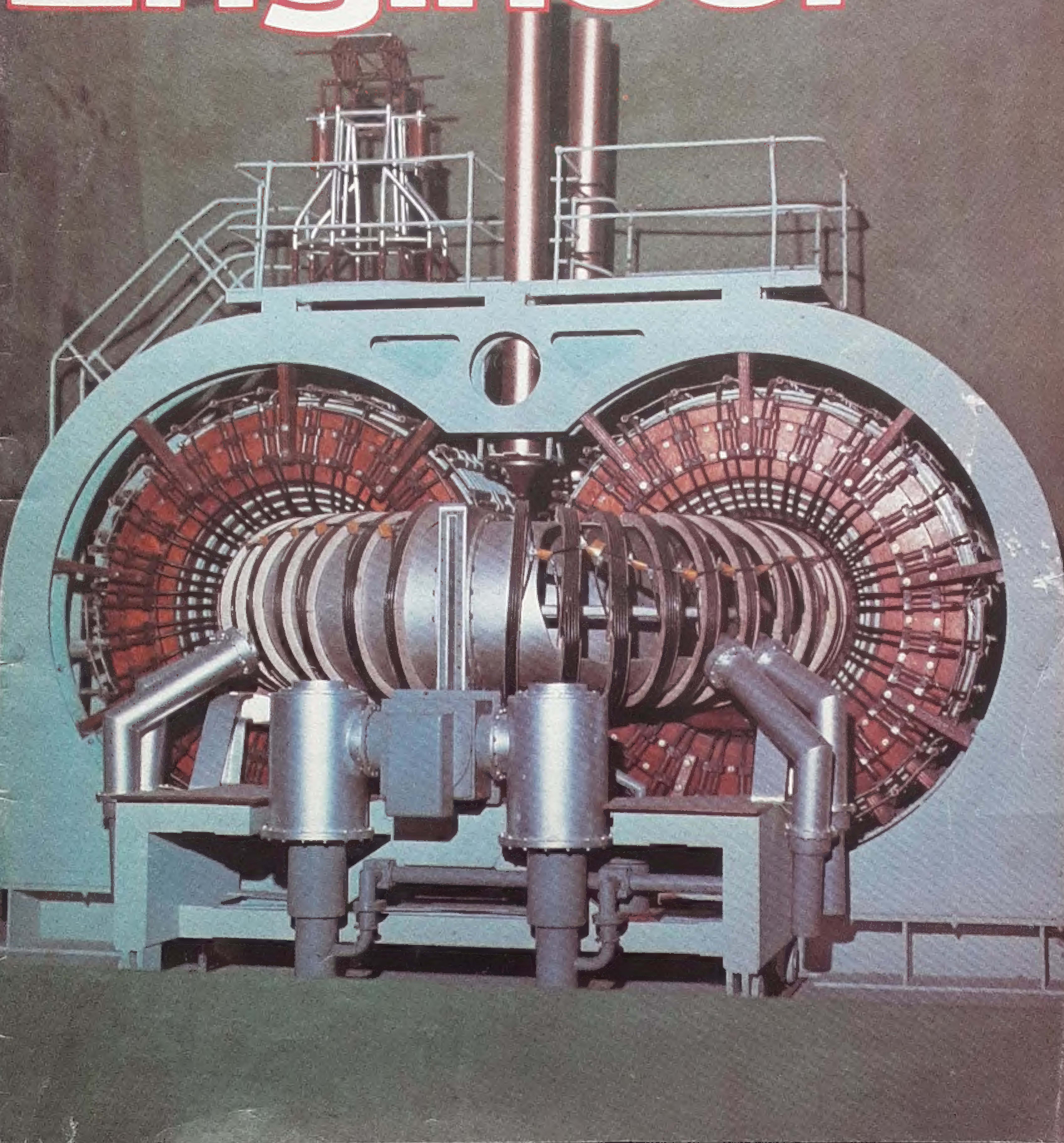
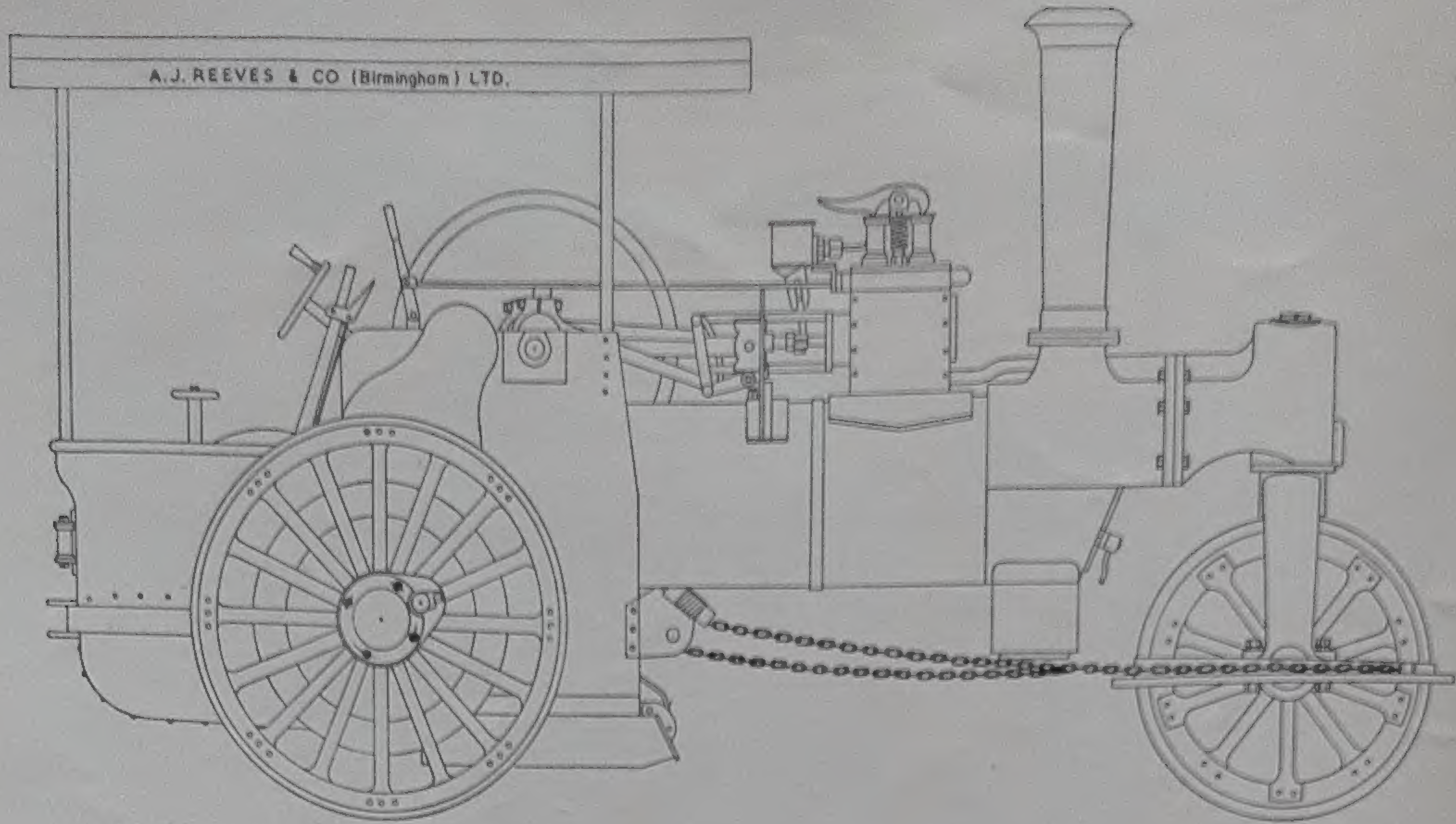
Model Engineer





THE "MINNIE" CONVERTIBLE

Convertible engines were used extensively by contracting firms and were hired out for agricultural, road haulage or road rolling use. The engines were built as a basic agricultural tractor but fitted with a specially adapted smokebox and saddle to enable easy conversion as required. This convertible version has been prepared by David Piddington using the 1″ scale "Minnie" design by L. C. Mason. The only alteration being the smokebox, to which the new components are fitted.

ROLLER CONVERSION

Drawing. R.V.47		75p	Front fork	1 GM	£4.54	Saddle	1 GM	£2.72
Front rolls	2 AL	£6.00	Steerage quadrants	2 GM	98p	Disc flywheel	1 CI	£1.41
Front hub centres	2 GM	£1.52	Lower fork bush	1 GM	68p	Rear spokes only		95p
Front hub in & out's	4 GM	£1.74	Fork head	1 GM	£3.25			

The following components, including drawings, listed for the "Minnie" Traction are required for the "Convertible" with the exception of the items marked with an asterisk.

"MINNIE" 1″ Scale traction engine by L. C. Mason

Drawings. T.E.1 (9 sheets)		£7.64	Motion plate saddle	1 GM	44p	Steering worm & wheel		£3.30
Flywheel	1 CI	*£1.69	Feed pump body	1 GM	99p	Spur gears. Set of 8		£12.00
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Winding drum	1 CI	£1.30	Rear wheel inside covers	2 GM	£1.39	Horn & spectacle plate matl		45p
Rear wheel rims	2 AL	£3.36	Rear wheel caps	2 GM	58p	Smokebox door	1 GM	*53p
Front wheel rims	2 AL	*£1.50	Construction manual		£3.95	Steering wheel	1 NS	46p
Chimney	1 AL	75p	Shaft bearings	1 GM	£1.85	Driving centre L.H.	1 CI	30p
Cylinder block and covers	3 GM	£4.24	Chimney saddle	1 GM	*93p	Driving centre R.H.	1 CI	30p
Cylinder liner	1 GM	46p	Steering chain		50p	Eccentric straps. V.G.	2 GM	37p
Valve chest	1 GM	66p	Wire rope		75p	Eccentric strap. Pump.	1 GM	23p
Regulator chest	1 GM	53p	Smokebox ring	1 GM	*73p			

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Model Engineer

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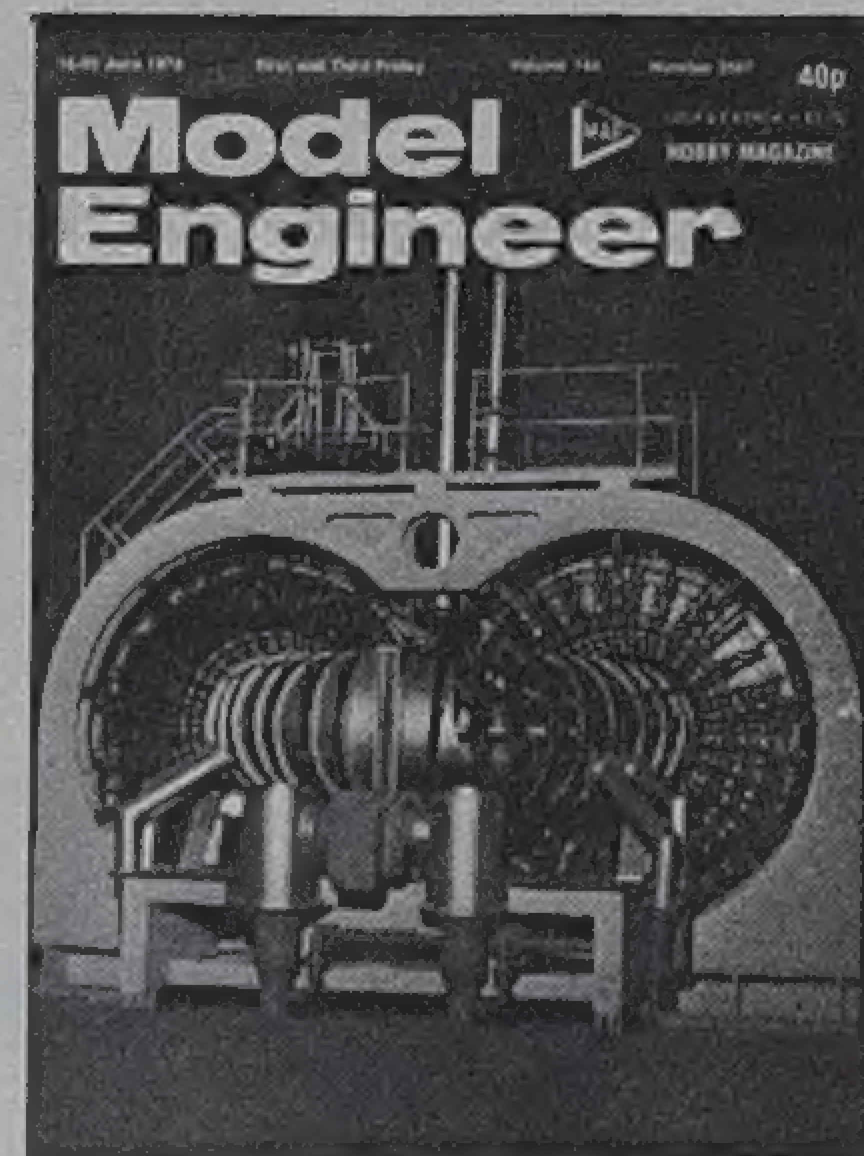

Model of ZETA nuclear reactor. Photo by W. David Askham.

NEXT ISSUE

A plough to fit John Haining's tractor.

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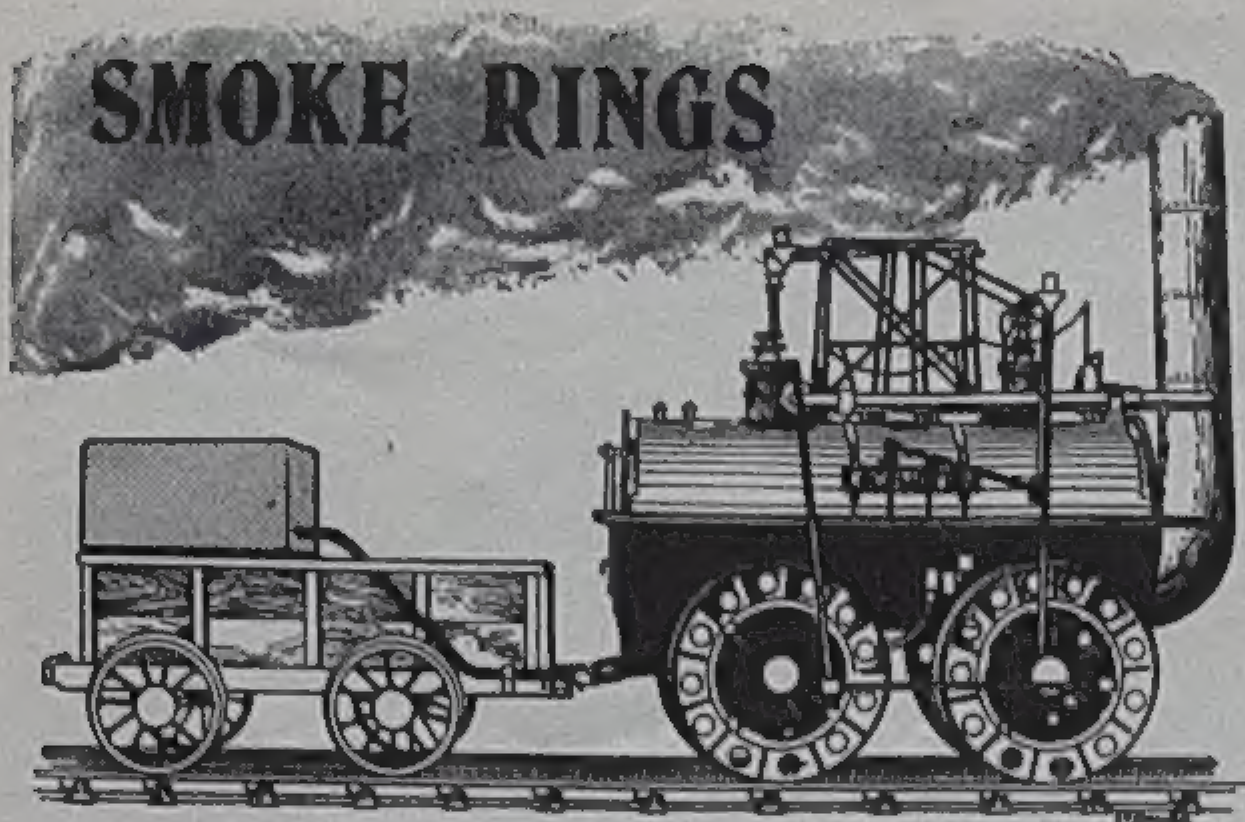
JUNE 1978



A Commentary by the Editor

After IMLEC

By now you should all know that this year's IMLEC is to be held on 9 July and that Guildford M.E.S. is to be the host club. I do know that they have been putting in a lot of hard work preparing a booklet which serious followers of these trials would like to buy. Given good weather — like any outdoor event — this IMLEC promises, as usual, to be well worth a visit. The list of entries is now closed and it makes interesting reading, covering a wide range of types and periods of locos. But what of the following week-end? The date fixed for IMLEC was determined by Guildford's own Model Engineering Exhibition and Model Traction Engine Rally which is scheduled for the following week-end, the 15/16 July. I paid a visit to last year's event and a very pleasant affair it was too. One of the outstanding spectacles is the exhibition of models in the marquee which usually contains several fairground subjects. It was, of course, reported in *Model Engineer* and will be again this year. But no report can equal the real thing so may I suggest that you make Guildford the venue for that week-end?

W/Cdr. F. Butler

Mr. S. E. Janes has written to give us the sad news of the death on Easter Monday of Wing Commander Freddy Butler while on a visit to his brother in the Nottingham area. Wing Commander Butler will be remembered by regular readers of *M.E.* for his articles, mainly on electrics, such as running a three-phase motor on a single-phase supply. An oscillator designed by him carries his name. Mr. Janes, who illustrated his articles with photographs, informs us that the workshop used by W/Cdr. Butler is up for sale.

Locos to come

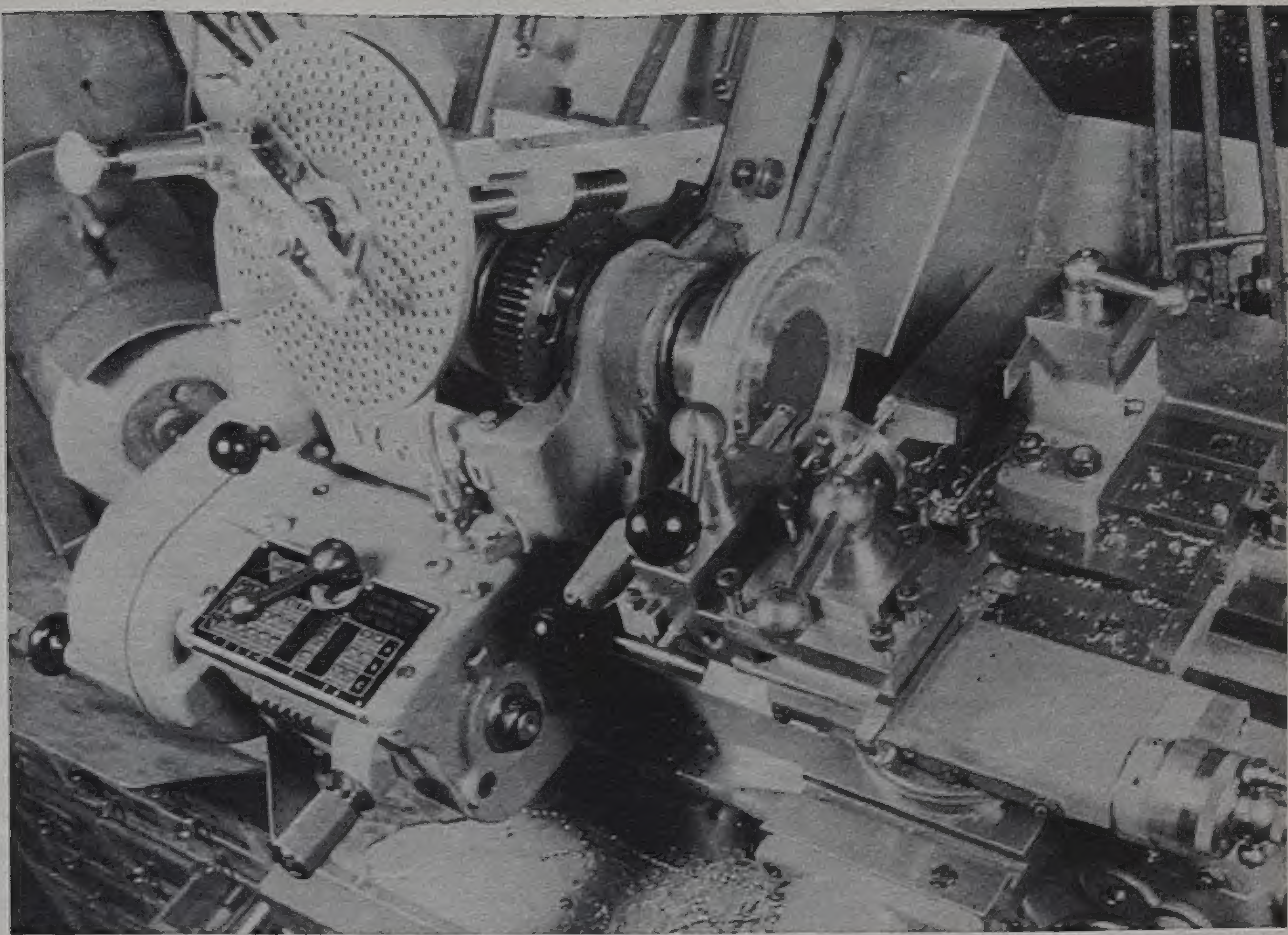
Earlier this year I remarked in these columns that Martin Evans will be following his popular loco designs currently running with two further designs which had at that time not been decided. Now they are. For the followers of Martin's designs, here are the facts. The first loco to finish will be *Evening Star* on 21 July. *Holmside* will finish on 4 August and *Greene King* on 15 September. The first of the new designs will be a 5 in. gauge L.N.E.R. V.1 (*Enterprise*) and this will start on 1 September. Then American loco enthusiasts will be delighted to know that on 20 October a series will start on a 3½ in. gauge 4-8-4 which has not yet been named.

Swindon draughting

Bert Perryman has been receiving a bit of correspondence since his article on "Swindon Draughting" appeared in the 5 May issue and he has requested that a piece of information not available at the time of publication be given in these columns. It concerns the easiest way in which to obtain the vital 1 in 14 taper and is this: set the top slide on the lathe to 4°; to check if this is correct, the larger diameter should be choke diameter + 5/32 in., at a point 2½ in. above the choke.

And you don't need planning permission

Smaller gauge loco builders and those readers who just like architectural modelling will be interested in this construction of "the perfect English Village". Its name is Acorn Magna and it was designed by the *Daily Mail* and the National Trust for this year's Ideal Home Exhibition held at Olympia, and also exhibited in Manchester during May. Some 43 historic village buildings in the care of the National Trust were selected over a period of six months for rebuilding to 1 in. scale. The whole village covers 1500 square feet. The church is the tallest building, standing three feet high and was modelled on Staunton Harold in Leicestershire. The village depicts English rural life in 1908 and is the brainchild of designer Tim Hopewell-Ash. The model will be going on tour and is obviously well worth seeing.



DIVIDING AND DIVISION PLATES

Part II **By Geo. H. Thomas** *From page 646*

BROWN & SHARPE standard plates for 40:1 ratio use 18 rows as follows: 15, 16, 17, 18, 19, 20, 21, 23, 27. And 29, 31, 33, 37, 39, 41, 43, 47, 49.

Cincinnati and several British manufacturers have 22 rows on their two standard plates for 40:1 ratio as follows: 24, 25, 28, 30, 34, 37, 38, 39, 41, 42, 43. And 46, 47, 49, 51, 53, 54, 57, 58, 59, 62, 66. These will give every number from one to sixty, all even numbers and multiples of five up to 120 and a further 52 numbers up to 400 plus larger numbers. Cincinnati plates are usually thicker than average and are double-sided with blind holes so that as long as No. 1 is on the machine there is no fear of losing number two, which is on the other side!

"Senior" small dividing head (40:1 ratio) has standard plates with 13 rows as follows: 15, 16, 17, 18, 19, 20, 21. And 23, 27, 33, 39, 45, 52. There are seven numbers below 50 which are unobtainable with these plates.

The "Myford" dividing attachment with 60:1 ratio uses two standard plates totalling 15 rows and there are two extra plates with a further twelve rows. These correspond fairly closely with the industrial 60:1 plates and are as follows: 32, 34, 38, 45, 49, 77, 91. And 29, 31, 37, 41, 42, 43, 46, 47. The two extra plates are; 27, 61, 67, 73, 83, 97. And, 53, 59, 66, 71, 79, 89. The two standard plates give every number up to 52 and, with the exception of 13 numbers — mainly large primes — all numbers up to 100 and, of course, many beyond. The two extra plates fill in the gaps but they are rarely used in connection with the normal run of work. It will be observed that plate I has only seven rows compared with eight in No. II and I have proposed that an extra row having fifty holes be interposed between 77 and 49. This is useful for obtaining 125 divisions and for thousandths of a turn which is required when dividing vernier scales.

Enough has now been said to enable the reader to make a satisfactory choice of worm-wheel and plates; for my own part I am convinced that a 60T wheel is the best because 60 has more factors than any other number of comparable magnitude.

We come now to the seemingly difficult matter of making division plates but if this is carried out in a methodical manner and with reasonable care it is not at all difficult to produce a set of plates capable of turning out work of a very high standard. Over the years there have been many methods described but several of these have used a fairly large temporary plate on which the correct number of spaces has been established, sometimes by very ingenious means, and, by mounting this plate on the end of the mandrel, this spacing has been transferred directly to the final plate. In order to reduce the errors in the temporary plate as far as possible it is customary to make these plates, often of plywood, very large — as much as three feet in diameter — and many workers would find it quite impossible to mount such large plates on their lathes. I do not propose to discuss these methods but will confine myself to the method by which the transfer is made from the temporary plate *through the dividing head* which has the effect of producing a much more accurate plate from a less accurate template. Temporary plate is rather a lot to write so I shall refer to it in future as the "template".

It should be made clear right from the outset that, with some form of dividing gear attached to the mandrel, the final plate will be held in a chuck or backed up by wood on a faceplate and the actual drilling accomplished by means of a separately driven milling or drilling spindle mounted on the saddle. Further, the descriptions will be based on the making of Myford type plates for use on the Radford (or other) dividing attachment using a 60:1 ratio but the methods are applicable to any size or type of plate.

Why transfer from the template to the final plate through the dividing head? Let us suppose that there is an error of one degree in one of the spaces of the template — probably the last one marked off. In order to complete a circle of holes on the finished plate the indexing arm will have to make 60 complete revolutions and each time the arm passes through the 1° error, the mandrel will turn through one-sixtieth of this amount so the final outcome, so far as the finished plate is concerned is that the single error of 1° will be transferred into 60 errors, each of one minute, uniformly distributed round the plate. At 3 in. radius, 1° is equal to about .050 in. on the circumference and therefore the errors of spacing in the final plate will be of the order of .0008 in. and anyone who can drill hundreds of holes to that standard of accuracy might well take the name "Gunga Din". It will be obvious that the same reduction of error will be repeated when the final plate is used on the dividing head for the purpose of making, say, a gear. The errors of one minute in the plate will now be reduced to only one second which is too small for me to contemplate. (It is actually the angle subtended by a height of one inch at a distance of 3¼ miles.) So we can fairly say that the method is completely self-correcting. For the spacing out of the templates I have devised a modified method which will, I am sure, make the work less onerous and the results more accurate than anything I have seen described in the past.

My Myford plates I and II are 6 in. dia. x .250 in. thick and numbers III and IV are 6½ in. dia. x .250 in. thick. The holes are .125 in. dia. and the spacing between rows variously 7/32 in. to 9/32 in. I would be inclined to make the holes a little smaller, say .110 in. (No. 35 or 2.8 mm.) and to keep the distance between rows to 7/32 in. Having decided how large to make your plates, get some flame-cut discs of good quality "boiler plate" about 5/16 in. thick but don't expect it to turn like a piece of free-cutting stuff. It will probably take kindly to a tool having about 7° front clearance; about 25° rake and a radius of about .040 in. to .060 in. With material of this kind it is sometimes difficult to maintain a high finish over such a large area and I notice that the Myford plates are surface ground before drilling. Anyone with facilities handy might consider this.

The template(s) could be made of stoutish sheet metal about 1/16 in. thick; clean bright m.s. would be suitable but brass or Dural preferable. An alternative would be ¼ in. birch plywood with a good quality smooth drawing paper glued to both sides. Don't attach the paper until after the hole has been bored. Use marking blue on the sheet metal if you like it, I avoid it if I can. Before completing the dividing attachment there are one or two detail matters which should be mentioned. The spring-loaded plunger should have a fine point at the tip (see fig. 2, 12) which will locate in the centre-punch dots in the template, but see the descriptions of some details at the end of the article. A plug gauge and drill-jig will be required and these simple parts will perform a number of useful functions. The gauge is made from ¾ in. m.s. faced off clean to the centre — no pip — and turned down to the same diameter as the plate spigot for a length of 17/32 in. This must have a *very* small centre made exactly in the middle of the end, using a centring tool as shown at fig. 1, 6. The plates, template(s) and ring jig (fig. 1, 3) should be bored to a good fit on this gauge after which it can be cut up as indicated by the parting lines in fig. 1, 2. A slice 3/32 in. thick is parted off from the end and the parted face filed flat. This forms a false centre to be used in the template for scribing the circles for the rows of holes. Before using it, the small pit in the end is deepened slightly

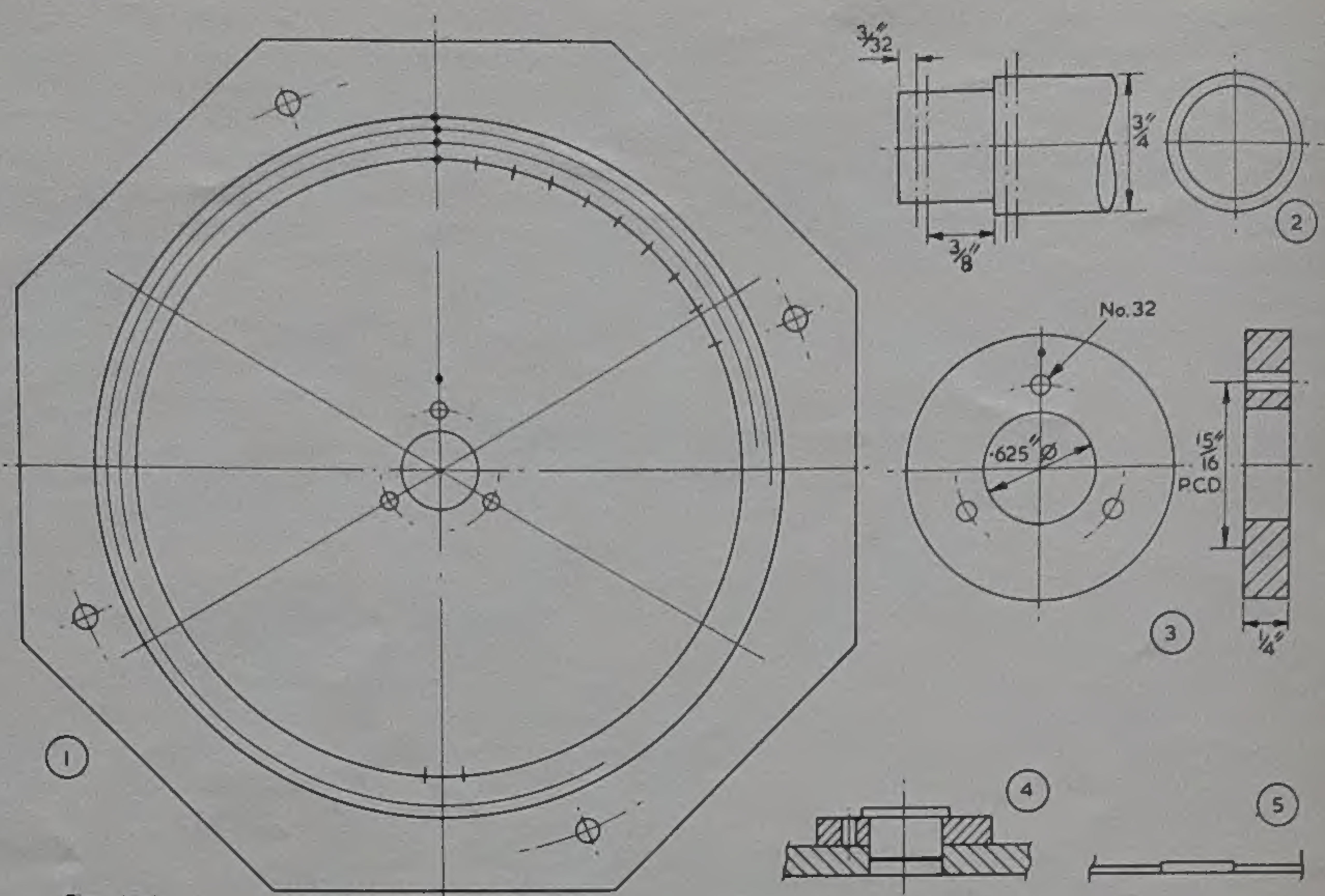

3/32"
3/4"
3/8"
2
No.32
·625"Ø
15/16" PCD
1/4"
3
1
4
5

Fig. 1(a)

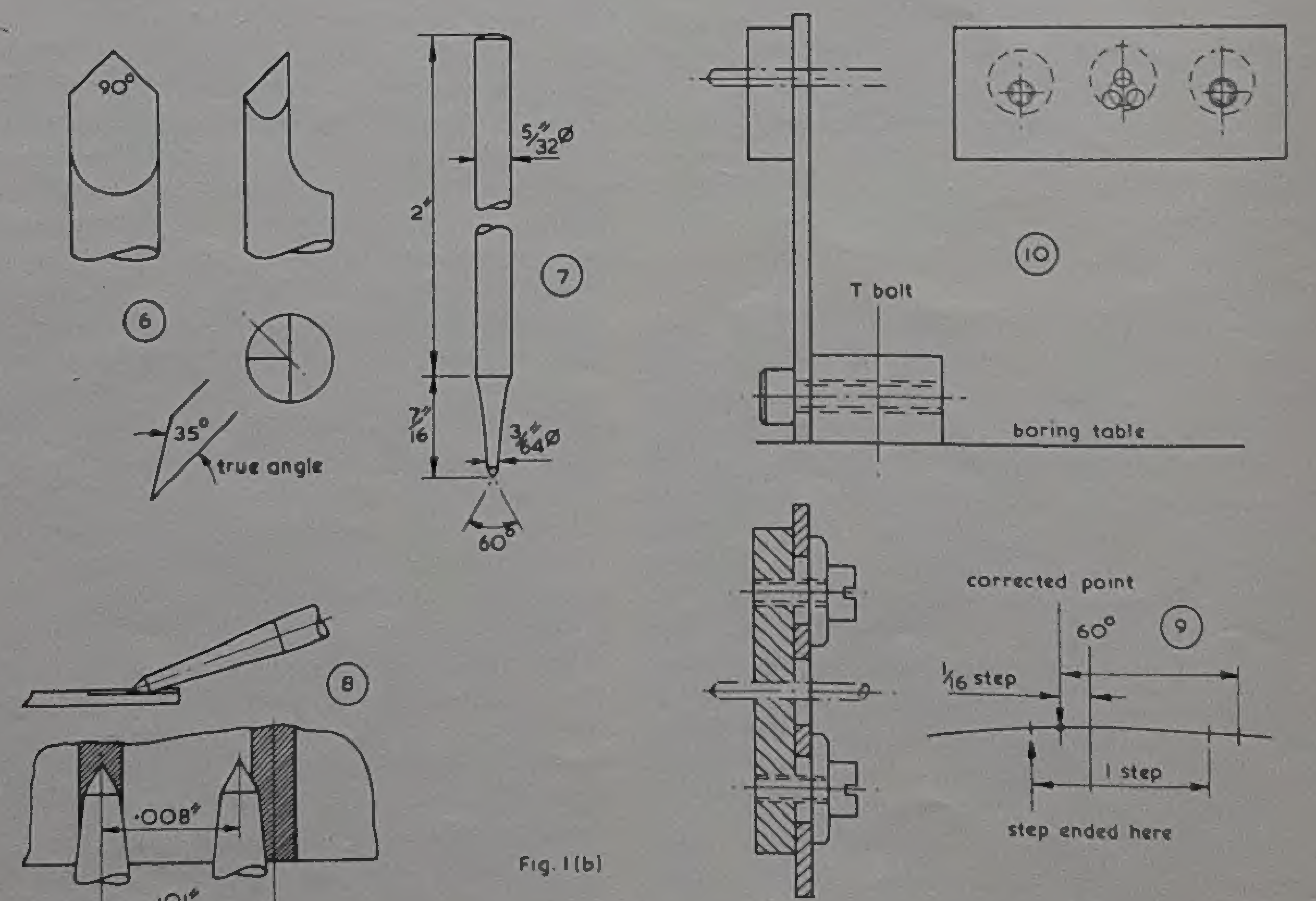

90°
35°
true angle
6
5/32"Ø
2"
7/16"
3/64"Ø
60°
7
10
T bolt
boring table
8
·008"
·01"
corrected point
60°
9
1/16 step
1 step
step ended here

Fig. 1(b)

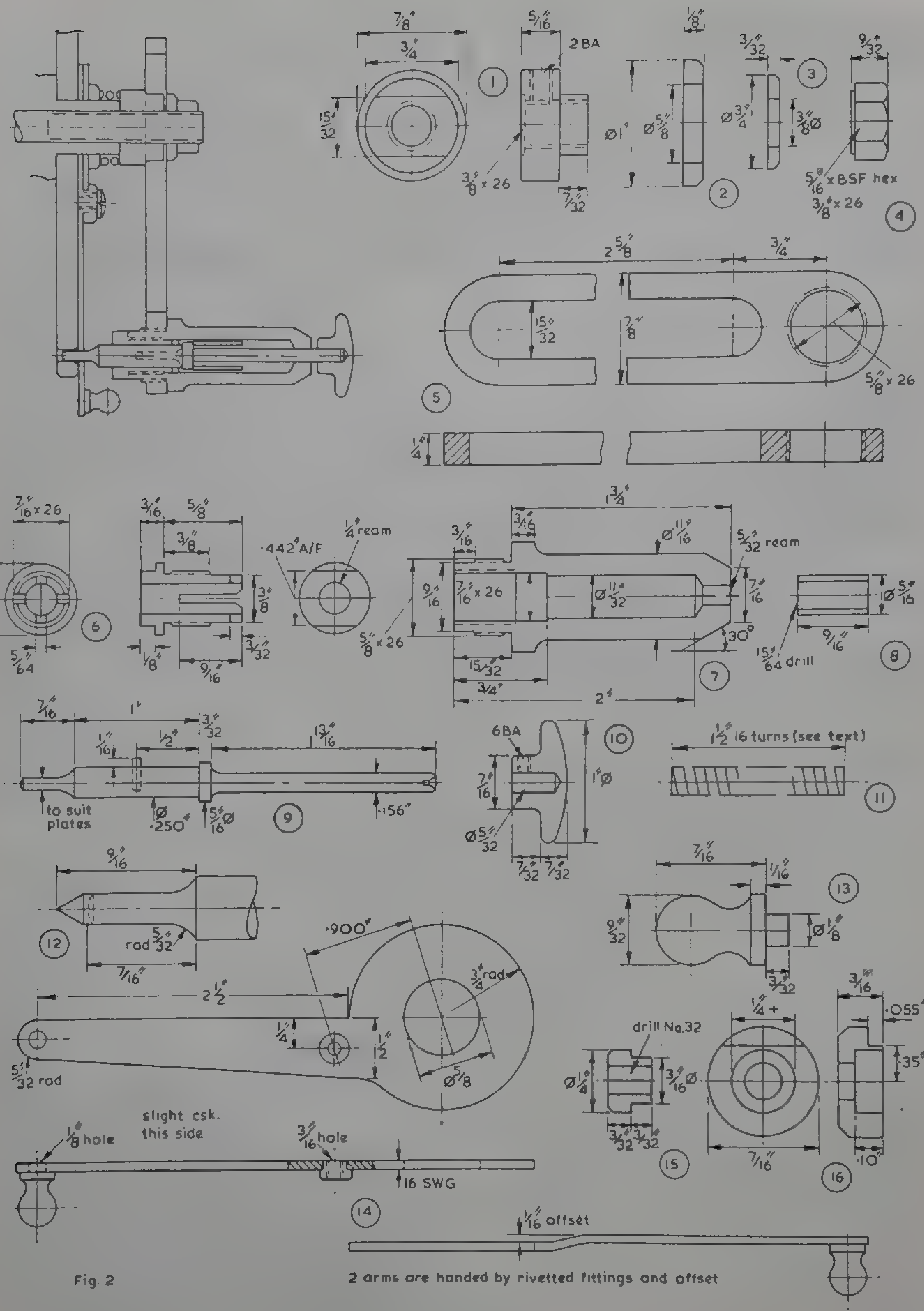

2BA
5/16" x BSF hex
5/8" x 26
.442" A/F
1/4" ream
5/32 ream
15/64 drill
1 1/2" 16 turns (see text)
6BA
to suit plates
·900"
3/4" rad
5/32 rad
slight csk. this side
1/8" hole
3/16" hole
16 SWG
drill No.32
1/16" offset
2 arms are handed by rivetted fittings and offset

Fig. 2

and sharpened up by means of a small and very sharp centre-punch (60°) and a one ounce hammer. A suitable centre-punch, which is going to have a lot of work to do, is shown at fig 1, 7. The false centre is shown in position in the template in fig. 1, 5.

Another portion is parted off the gauge leaving a little flange about 1/16 in. thick. This will form a locating plug for the ring jig as shown in fig. 1, 4. When turning the ring jig, a fine circle can be scribed on it at 15/16 in. dia. on which the three holes (4 BA tapping, No. 32 or 3 mm.) should be marked equidistantly and subsequently drilled. This jig will be used, not only on the plates and template, but it will also position the tapped screw holes in the bearing member which carries the plates. As the jig will not be hardened it would be as well not to enter the drill more than about 1/16 in. into the plates, finish them through afterwards and then open up to No. 27 and countersink for the screw heads. A small refinement of method (as old as the hills) which could save a lot of annoyance later is to make a dot against one of the holes in the ring jig and to transfer this dot to all of the plates and templates when they are drilled with the dot uppermost. The screw holes will be countersunk on the dotted side of the plate. As will be seen from fig 1, 1, all the circles of holes start from a common radial line and if this is scribed approximately in line with the dot on the face of the plate then all plates will take up the same attitude when they are attached to the bearing bracket which will probably save a certain amount of trial and error involving the fitting and removal of screws. Of course, if the three holes were equidistant from the centre and spaced exactly 120° apart there would be no point in such subterfuges but not everybody works like that and the dot takes no time at all.

The template will be best made with the largest circle about 6 in. dia., if larger it would be too large for our indexing arm and sectors. We set a pair of dividers (5 in. or 6 in.), in very good condition, to scribe a circle about 6 in. dia. on the template, using the plug in the centre hole. The scribed line should be fine and sharply incised so that it can be felt with a sharp scriber. Make a sharp dot on the circle opposite the dot against a screw hole and, being very careful not to alter the setting of the dividers, start from the dot and take three steps clockwise and then three steps anticlockwise from the same starting point; the third steps should cross on the circle and if they do not, take a critical look at the points. Now, using a straight-edge, scribe three lines across the plate by joining up opposite marks on the circle. Do this carefully.

We have to settle the number and spacing of the rings which will depend upon the plates to be made. Based upon a minimum comfortable spacing between circles on the template of ⅛ in., all the circles for four plates could be marked out on the two sides of one template or, if only the two standard plates are wanted, both sides of the template could be used with circles at about 3/16 in. apart. At ⅛ in. pitch the 15 circles for the two standard plates will take up a radial distance of 1¾ in.

The usual procedure with jobs of this kind is to take an inspired guess at a setting for the dividers and start stepping round the circle until it is realised that inspiration is at a low ebb that day and so we alter the screw. How much? We don't really know. The movement at the points of my 2 in. dividers is almost four times the movement at the screw which helps to make things even more difficult especially when fairly high numbers in the circle are involved. There are two ways in which the process can be simplified; firstly by setting the dividers as accurately as possible to a *calculated dimension* and secondly by dividing all the circles into six equal parts by means of the three lines which we have scribed across the template. The following method of working includes both of these features but first let us take a look at the tools we shall be using.

For all work of this kind the dividers should be small and rigid, preferably of the "toolmaker's" type with round legs. The legs should be of exactly equal length and both points truly sharp so that they will rest on a thumb nail inclined downwards at 30° to 45°. If yours are not like that, put them in good order first, using an oilstone slip and preserve the points by keeping a cork on them. My own smallest dividers are 2 in. Brown & Sharpe No. 800 and the M & W No. 65/2 are very similar. A very good alternative, possibly even better, is a pair of draughtsman's stout spring-bow dividers with removable needle points. I have some about 3½ in. long overall, they handle very well and possess the great advantage that the points can be removed, trued up and sharpened with a fine hone whilst running in the lathe, and they are easily adjusted to correct length. Other tools; a really sharp scriber; a fine centre-punch like the one in the drawing which can be kept in condition whilst running in the lathe and which gives excellent visibility; a hammer, 1 to 2 ounce (watchmaker's type — easily made if you feel inclined) and, finally, a worthwhile rule having decimal grads with at least 1 in. divided into hundredths. I use the hundredths for judging the quality of the rule; I want to see the spaces between the lines about three times as wide as the lines which means, if you sort it out, that the lines should not be more than about 2½ thou wide. The grads *must* be *cut* into the rule; the satin-chrome style with grads seemingly printed on them, whilst they are very nice to use and read for ordinary work, are useless for the job we have in hand. My own "best" rule is a Chesterman rustless No. 417D/3.

To be continued

A LOGGING LOCOMOTIVE IN LUCERNE

by R. M. Tyrrell

THE SWISS NATIONAL TRANSPORT MUSEUM in Lucerne always tries to provide a new attraction for its visitors. Its latest acquisition is a most unusual model steam locomotive. It runs a passenger-carrying service on a sharply-curved continuous, short track in the museum grounds.

This engine is a 2 in. scale model in 9½ in. gauge of a prototype that was very common in the U.S.A. from 1898 right up to the 1940s when diesel caterpillar tractors took over in the great logging forests.

As distinct from the well-known "Shay" type, with vertically-mounted cylinders on one side of the chassis, driving a horizontal shaft geared to the driving wheels, this "Climax" design is quite different.

Its two cylinders are placed above the running-plate, above the front bogies, and the connecting-rod drives a jackshaft (see Fig. 2). This latter, through bevel-gears, drives two carden-shafts, one fore and the other aft. These shafts, again with bevel-gears, drive the nearest pairs of bogies and the further two pairs are thence chain-driven. In this way all eight wheels are powered. A fairly complicated arrangement — but it works.

In the prototype, the object of all this was to make a locomotive that could tackle the very sharp curves and roughly-laid track that was used in the logging forests — track that was often laid down one week and torn up the next — as the huge trees were felled and a new area was opened up.

Fig. 1. "Climax" type loco in 24 cm. gauge referred to in the text.

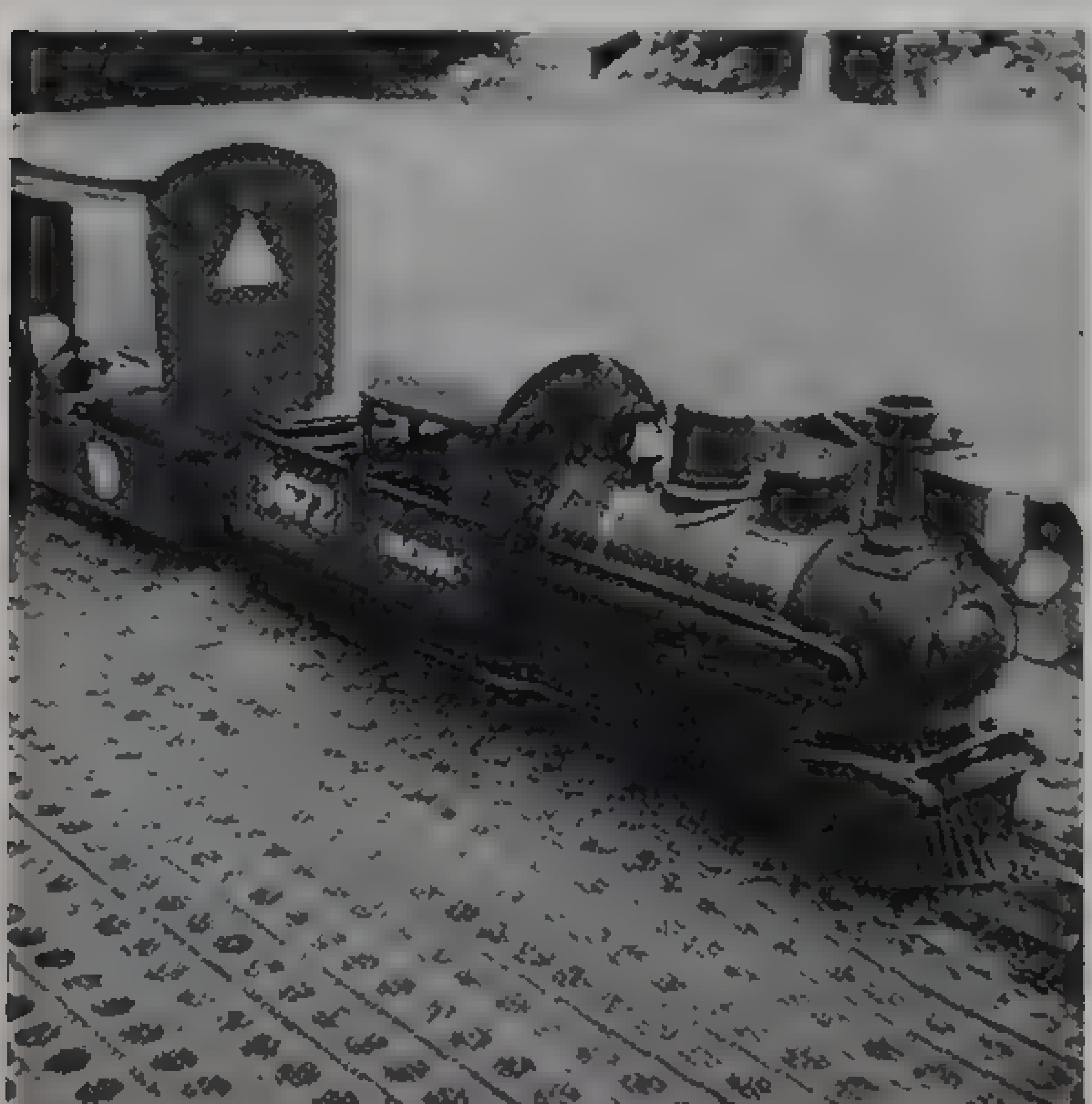


Fig. 2: Close up of the valve gear.

This model weighs some 12 cwt. with tender, and the working-pressure is 120 lb./sq. in. Its origin is somewhat mysterious, but, according to the present driver, it was constructed by a Swiss enthusiast in 1916. Certainly, it must be one of the most unusual model steam locomotives operating in Europe today.

Due to the strict Swiss laws against pollution, the engine burns anthracite and never exhibits that yellow-brown smoke which is apparently so beloved by some Continental firemen! The Swiss National Transport Museum is an absolute "must" for any model engineer who can afford to pass through Switzerland. With its superb collection of railway relics, vintage cars and antique aeroplanes it merits a whole day's visit. There are two restaurants. One is an old paddle-steamer of the 1860s era, with its twin oscillating cylinder engines still preserved in working-order and to be seen in movement, driven by an electric motor.

There are also adequate car parks, caravan parks and bathing facilities in the immediate area. The museum is about ten minutes' ride by trolleybus from the main railway station.

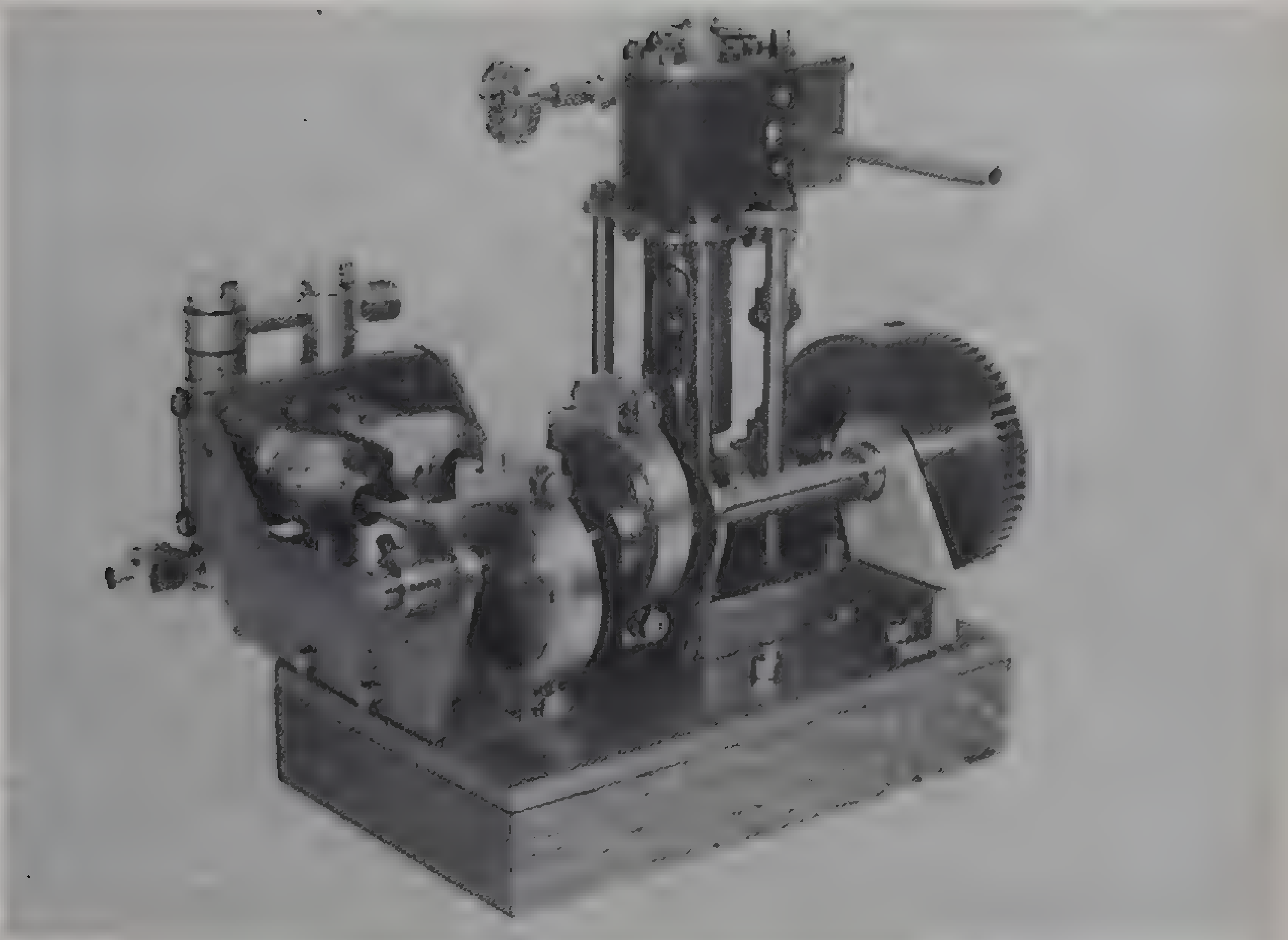


Fig. 2: Fitted with boiler feed pump

MORE UTILITY STEAM ENGINES

by J. P. Bertinat

THE SMALL VERTICAL ENGINE is perhaps the most versatile and widely used model steam engine, finding many applications, e.g. for marine propulsion, generator driving and also as a beginner's exercise. Among the existing designs for which castings are available (in addition to the deservedly popular Stuart Turner range) are the Trojan and the Warrior, both of which were described by the late E. T. Westbury in *Model Engineer* in Feb.-Mar. 1949. These are respectively a single-cylinder engine of ⅝ in. bore and stroke, and a twin-cylinder unit of ¾ in. bore and stroke, both engines having gunmetal cylinders. The gunmetal cylinders will stand up to considerable use with moderately superheated steam, and have the advantage that precautions against rusting up during long standing periods are unnecessary. Both engines were basically excellent designs, but in my opinion the bearing areas were rather small for continuous hard work and I have built both engines to modified detail design, incorporating the standard castings available from Messrs. A. J. Reeves of Birmingham.

I will deal first with the Trojan which is here illustrated. Fig. 1 shows the engine fitted with displacement lubricator and Fig. 2 shows the same engine built into a gear-driven boiler feed pump unit. In this case the engine serves as an auxiliary to a larger Stuart engine.

Older readers (like myself!) will possibly recognise the resemblance of the Mark II Trojan design to that of the Stuart Turner Simplex engine which was very popular with power boat enthusiasts until its production was alas discontinued in the late 1920s. It is of interest to note that the later version of the Simplex was fitted with a trunk guide as to be advocated for the Trojan II, but the design was spoilt by the form of crosshead adopted; a large part of its effective bearing area was cut away to provide a slot for the connecting rod small end. I had good service from one of these engines, driving a 4 ft. steam launch on the Round Pond in Kensington Gardens, and remember as a schoolboy, purchasing a set of machined castings and parts for the Simplex from Bassett Lowke in Holborn for the

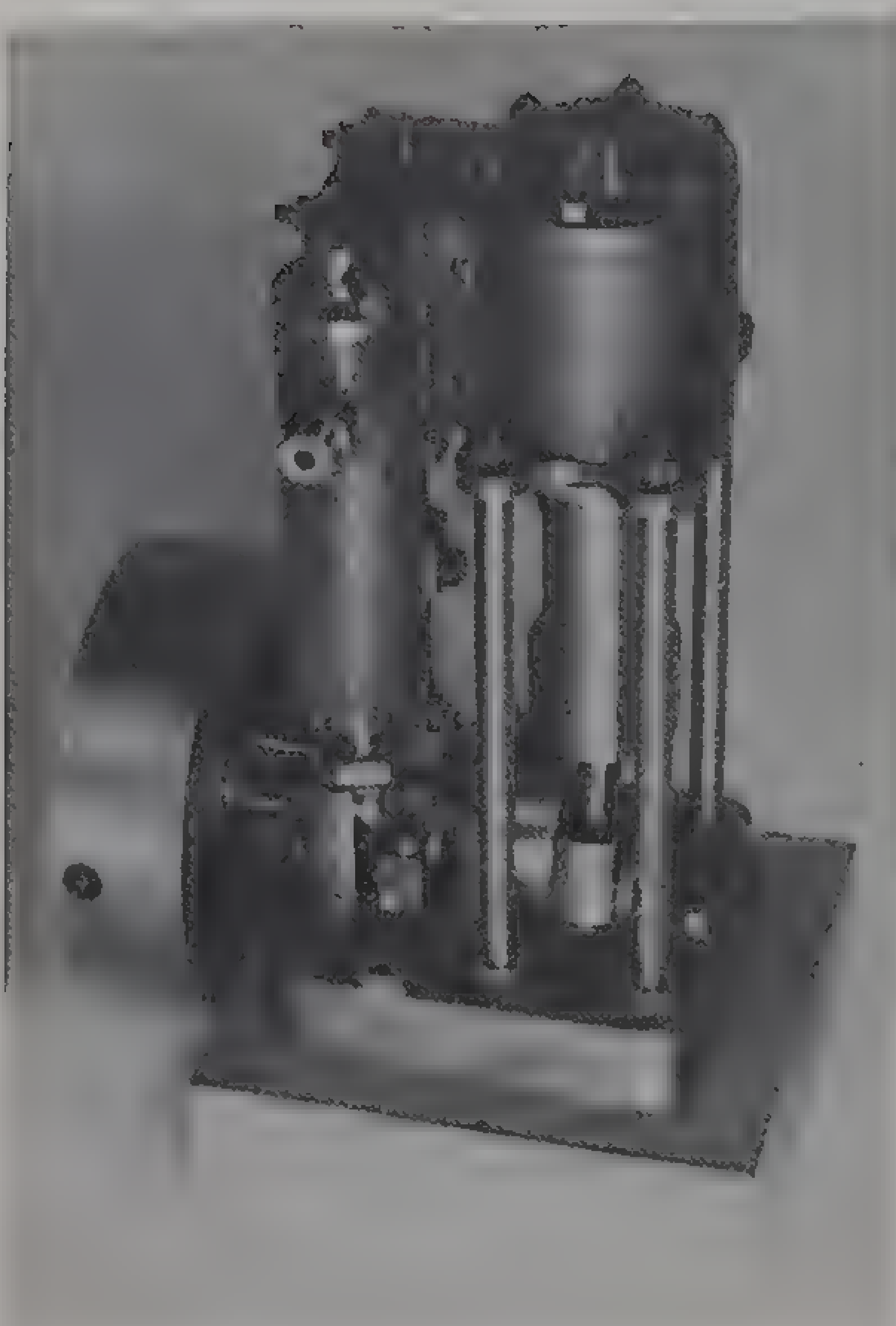


Fig. 1: Engine with displacement lubricator.

sum of 21s. — a lot of money in those days! Still reminiscing, a few readers may remember the outstanding performance of Will Savage's destroyer *Kismet*; this 4 ft. 6 in. model was powered by a Stuart Simplex driving twin screws. While on a recent visit to Stuart Turner's, their Director, Mr. A. Wadley, showed me a set of unmachined Simplex castings which had been recently recovered from New Zealand. I was given to understand that no patterns for the Simplex are now in existence, but I would like to see this engine revived in some form — perhaps this is sentiment, but I think not entirely so.

To return to the Trojan, the main area in which improvement was needed was in the crosshead and guides. The original design calls for a pair of ⅛ in. dia. guide bars which are entirely unsupported at their lower ends; these not only lack rigidity but will prove difficult to line up. Badly fitted crosshead guides are a prime cause of piston rod gland wear and of premature cylinder bore wear. Fig. 3 shows the General Arrangement of the redesigned or Mark II engine and it will be seen from this drawing and from the photographs that a trunk guide has been fitted. This was machined from steel bar and secured by its flange to the bottom cylinder cover. With this type of guide and with careful machining, alignment is obtained automatically. A bronze crosshead is fitted, of such design as to give adequate bearing area in the trunk guide.

The crankshaft and crankpin diameters have been increased from 3/16 in. to 5/16 in., and all moving parts have been stiffened up without (I hope) making them appear clumsy. Some designers criticise the overhung crank on the grounds that it produces a heavy load on the adjacent crankshaft bearing, but in the present case sufficient bearing area has been provided to give a long working life, provided that lubrication is attended to. In any case the bearings are plain unsplit bushes which may be renewed with comparative ease should the necessity arise.

The gunmetal flywheel fitted to the original Trojan engine has been replaced by a larger cast-iron wheel similar to that specified for the Warrior engine, since the boss of the gunmetal wheel was too small to accept the increased bore. Reference to Figs. 1 and 3 shows that a pinion has been fitted for driving a boiler feed pump (I prefer to see feed pump provision incorporated into the original design rather than, as is often the case, tacked on as an afterthought). To avoid the increased overhang that would result from using a separate boss and fastening for this pinion, its elongated boss is a press fit in the hub of the flywheel, and a single Allen screw serves to secure both to the crankshaft. An additional advantage of the alternative flywheel is that its outer face is flat and is thus useful for fitting the pin coupling usually employed in marine drives. It is realised that the pinion used is not a standard commercial item (I usually cut my own), but a similar arrangement could be made with a standard gear, the boss in this case not extending the full length of the flywheel boss; I will detail this alternative.

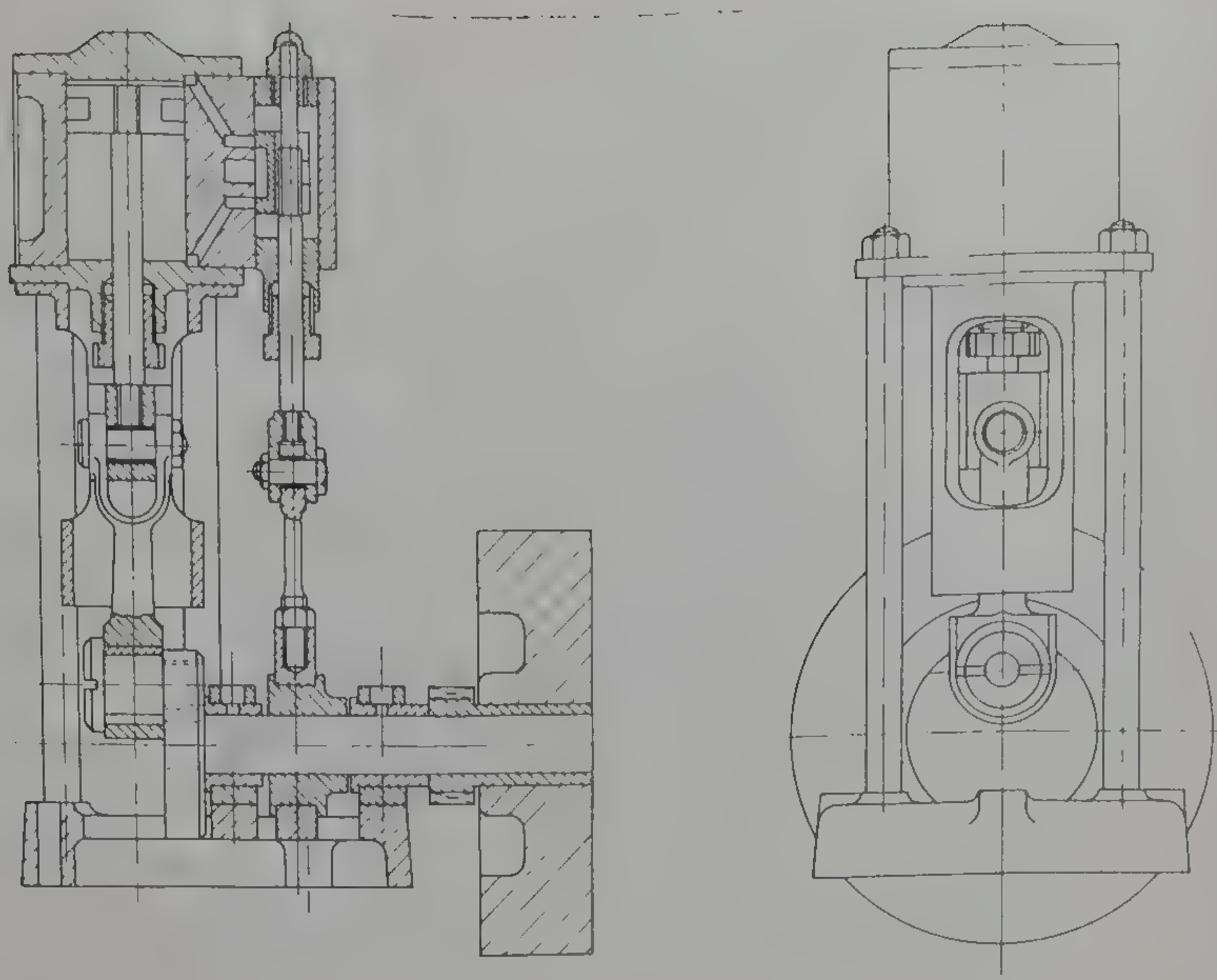
The slip eccentric reversing gear which featured in the original design has been dropped; it is not normally required, and as I have found out with my Reeves Co Monarch engine, it sometimes makes starting up a bit tedious especially when clearing the condensate. In any case the design of the crankshaft is only really suitable for clockwise rotation viewed from the flywheel end, since otherwise the crankpin will tend to unscrew with disastrous consequences. Another wear-reducing feature has been introduced into the valve gear, viz., a tail guide for the valve spindle.

Details of Construction

Fig. 4 shows the Reeves castings used in the construction of the engine and Fig. 5 shows details of the cylinder block and its covers.

Cylinder Block. Fig. 5.1

For the first operation, this component may be mounted in a four-jaw chuck and set so that it is



TROJAN (MARK II)

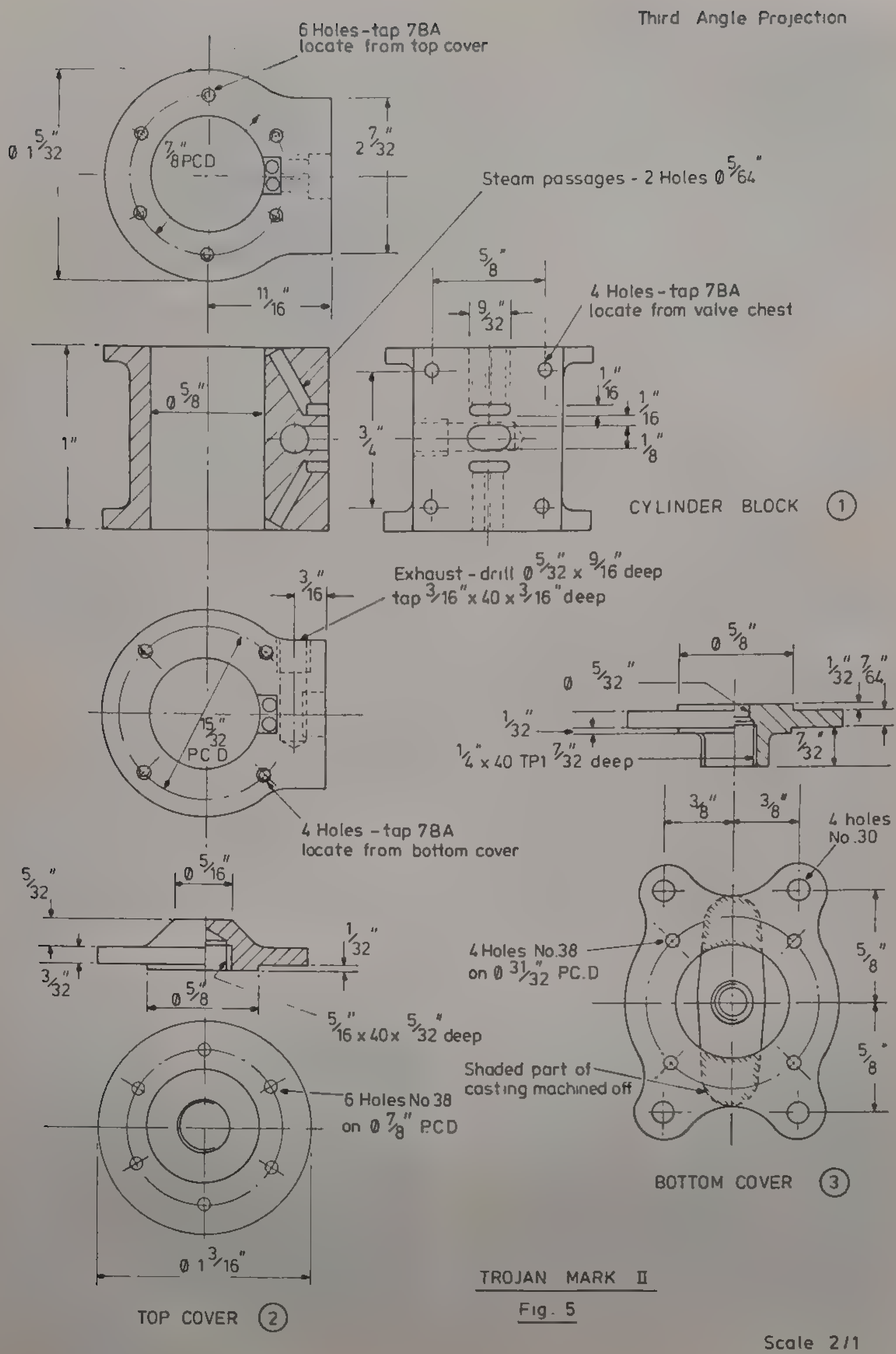
Scale 2 1

0·19" Valve Travel } 60 % Cut Off
0 055" Steam Lap

Fig 3

square to the chuck face and the outer flange is running truly (this is safer than setting by the cored bore although the latter seems quite central in the casting I have in front of me). When all is secure and the lathe is started up, both flanges and the body of the cylinder should appear to run truly, and if this is the case a facing cut may be taken over the cylinder flange, of sufficient depth to clean up the casting. We now come to the all important operation of boring. Fig. 6 shows a cylinder set up for boring, and another which has just received similar treatment is resting on the boring table. For the purpose of taking the photograph, the top slide of the lathe has been removed to show the "Duplex" rear tool post and boring bar holder in position. Readers may recognise the Drummond 3½ in. lathe which type has been discussed at length in recent issues of *Model Engineer.* Mine has been my constant workshop companion since I purchased it new in 1938, and although now motorised, much of its work (including the boring of the cylinders illustrated) is still done by one foot power. Unlike Mr. G. Thomas, I find my Drummond lathe no more of a "chatterbox" than my ML7, but I must admit that the Super 7 is a great improvement in this respect.

Commence the boring operation by taking a cleaning-up cut through the bore, using as stiff a tool as will enter the bore (I use a HSS cutter in a ⅜ in. dia. shank for jobs such as this), and try to clean the bore at one cut since any rubbing of the tool on the sandy surface of the casting will play havoc with its edge. I suggest you start with the lathe running at its lowest direct speed and feed by hand for the first cut — you will then be able to feel if the edge of the tool goes. The bore can now be opened out to its ⅝ in. dia. in stages; it should be possible to slightly increase the speed of rotation and with a well-sharpened and slightly radiused tool a good surface finish should be obtained. When approach-



TROJAN MARK II

Fig. 5

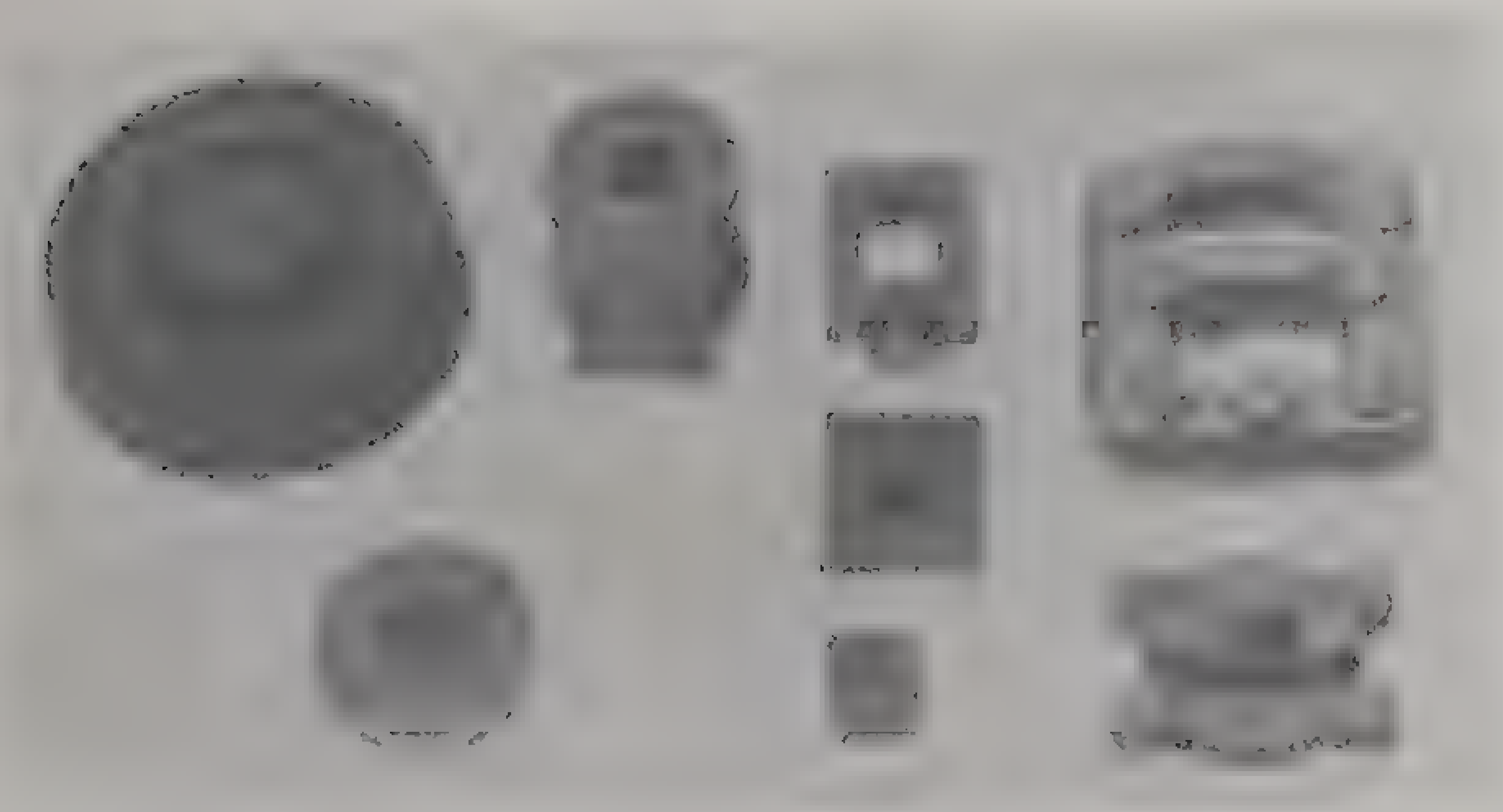


Fig. 4: Castings available from A. J. Reeves & Co (Birmingham) Ltd

ing the finished size, only small cuts must be taken and the tool passed through twice at each setting to eliminate the effect of any slight springing of the tool shank. Prior to removing the last thou or two, the tool edge is carefully honed. In the absence of any precision equipment for internal measuring, a piece of 5/8 in. dia. silver steel can be used as a gauge or, prior to boring the cylinder, a 5/8 in. dia. plug gauge can be turned up from any available bar material. Since commercial piston rings are not being used, dimensional accuracy of the bore is less important than its parallelism and surface finish; modern lathes take care of the former and your tool grinding and setting looks after the latter. With a keen, slightly radiused tool, the facing of the cylinder end may now be completed; feed outwards from the finished bore so that the tool comes into contact with only the minimum of "raw" cast material. Check that the amount of material removed will, when the other flange is machined to bring the casting to its 1 in. length, leave the two flanges of equal thickness. Before removing the work from the chuck a slight chamfer may be formed at the entry to the bore (this must be very slight since the locating spigots on the covers are only 1/32 in. thick. Before proceeding any further, put some identification mark on the face of the machined flange (in some place where it will not be obscured by the cylinder cover), to denote that this flange was machined at the same setting as the bore, and must be the one used to attach the bottom cover and trunk guide.

The upper flange of the block is readily machined by mounting the work by its bore on a truly running stub mandrel. The recognised way of machining the port face is to use the face plate/angle plate combination and my set-up is shown in Fig. 7. Note the large washer under the bolt head and the paper washers at each end of the cylinder block — these serve the dual purpose of increasing the grip and preventing bruising of the already machined surfaces. The port face will be correct in relation to the cylinder bore when it is 1/8 in. from the adjacent edge of the latter, and this distance should be marked out before setting on the angle plate.

To be continued

Fig. 6: Cylinder set up for boring.

Fig. 7: Machining the port face.

ETCHING SCALE NAMEPLATES

by R. L. Tingey

Part II *From page 654*

Etching the Plate

Mix the etchant just before use. Ammonium persulphate decomposes quite quickly in solution by itself, but remains more stable once the sodium chloride has been added; it will keep in a full, tightly-stoppered bottle for about a week.

To etch, place the plate into the bottom of a beaker or any flat based receptacle of plastic or glass, face up, and cover with etchant to a depth of ½ inch. Put the vessel into a water bath at 45 to 50°C. and agitate by swirling every minute or so, and after ten minutes wash away the etchant with warm water, dry and inspect the plate.

At this stage the plate will show a bright thin line at all resist covered edges. Any badly finished areas will be apparent and can be touched in with the nail varnish using a fine sable brush (the brush will clean out with acetone).

Repeat the etching process, giving no more than 15 minutes each time before discarding the bath, after this time the resist tends to start lifting at the edges. Each etch causes the exposed areas to darken as the solution goes to work, gradually turning yellow-green to green and finally increasing the production of gas bubbles to be quite fizzy at about 12 minutes. Do not over agitate with small nameplates as it tends to increase undercutting. Discard the hot solution after each etch, wash the plate and give it a quick inspection to determine the effect before renewing the bath and continuing the etching. Inspect the back and edges at this later stage as any poorly set nail varnish will be allowing etching in blocked out areas.

A small nameplate will need four or five changes to achieve a depth of 20 to 25 thou, and a larger plate up to ten etches, dependent upon how deep the relief is required to be. Small nameplates may be considered as those with letters up to ¼ in. high, and larger ones with letters over ¼ in., as a guide.

Finishing the Nameplate

After the etching is complete wash the plate, dry it and immerse in a small amount of acetone when the Letraset and the blocking out medium will be removed. Remove the nameplate and wipe over with acetone-soaked cloth before finishing off the plate mechanically.

Rub the top surface down on the crocus paper so that any pits or blemishes may be seen, small marks may be removed with a slip stone. Round plates, such as for the smokebox door of a traction engine, may be turned in the three-jaw chuck to be finished in the lathe. It is always better to make plates larger, initially, and to cut out and finish edges afterwards, rather than to etch a correct size of blank. Any blemishes on the edges can easily be filed or turned off.

When etching a number of names or numbers on the same sheet of brass or copper the various sizes of lettering may be controlled by blocking out the smaller ones with nail varnish when their correct depth of etch is achieved, and then continuing the etch for the larger names.

Diamond Footplating

Diamond patterned footplating can be easily made, in brass, by ruling out the pattern in nail varnish on the metal which has been cleaned and conversion coated, and then etching out between the lines in the chemical as described.

Parallel rules are helpful for marking out, and for a small scale pattern guide lines can be scored with an old ruling pen, its prongs opened the correct distance apart. For larger scale footplating the spring dividers can be used.

For one inch to the foot scale the lines should be about ⅛ in. apart and approximately 1 mm. thick, drawn at 30 degrees to each other. Depth at this scale need only be about 10 thou.

Letraset

Letraset is obtained from drawing office suppliers in a wide range of typefaces and sizes. Type size is described by a system which gives the width of the metal the type is cast on in points, for the benefit of the compositor. Thus a 72 point capital letter (upper case in the trade) can be anything from under 17 mm. to over 21 mm. high, dependent upon typeface. To get the correct size of letter it is necessary to check in the Letraset catalogue, in the shop, to see what size a particular typeface may be.

All Letraset sheets have spacing guides of short lines over and under each letter. If the guides are in the wrong position for your purpose a good tip is that letters should have the same *area* between them. If mistakes occur when pressing down the numbers or letters they can be removed from the metal with adhesive tape. Small holes or cracks in the letters can be corrected by painting over with the nail varnish.

A partly finished nameplate with ingredients.

"Clarendon Medium" is a good serif typeface for locomotives, and "Folio Bold" and "Folio Bold Condensed" for a sans serif type. If you prefer to use a Letraset line to make the diamond pattern, rather than rule it, Numbers 557 and 558 are sheets of lines and corners of various thicknesses.

Nameplate for "Vertigo", Rex Tingey's vertical valveless steam engine which is his next project for Model Engineer.

Finally

Other metals are not suitable for etching by this method. Aluminium is easily etched in strong acids and alkalis, but the Letraset falls off. I am, at present, experimenting with various etchants on steel, with conversion coatings for Letraset.

I am quite happy with the results on brass and copper, which give excellent plates.

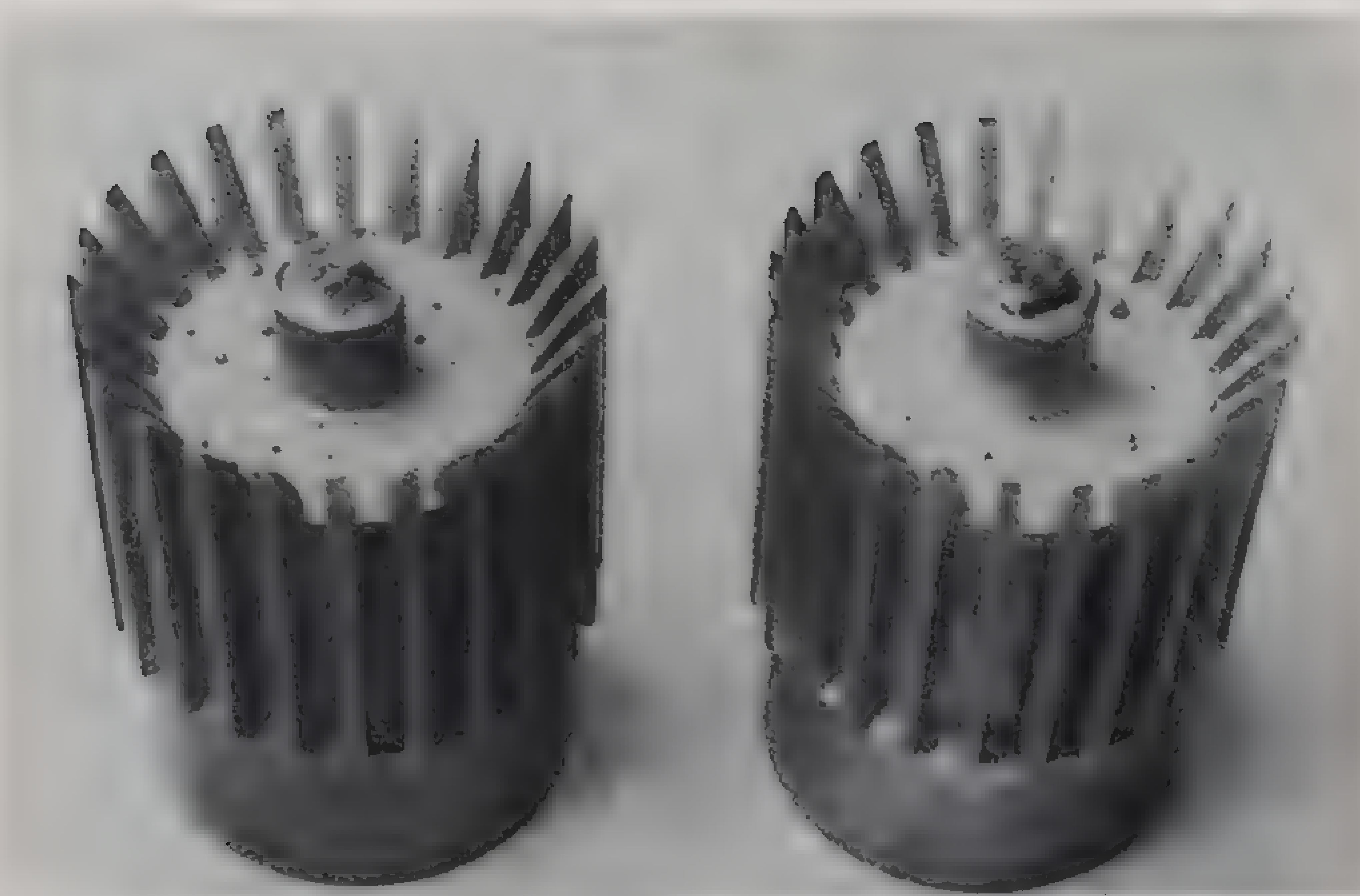
FORMULAE:

Conversion Coating

500 ml. water.
Add 8 ml. concentrated hydrochloric acid.
Make up to 1 litre with water.
Submerse blank in solution and agitate. 30 seconds for copper, 1 minute for brass.

Etchant

500 ml. water at 35°C.
Add 250 grams of ammonium persulphate. (1)
Make up to 1 litre with warm water.
Add 250 grams of sodium chloride. (2)
(1) Photographic or technical quality chemical may be used.
(2) Rock salt may be used.
Use, as described, at 40 to 45°C., immersing blank for no more than 15 minutes each etch.



A WAX PATTERN DIE FOR A FINNED STIRLING ENGINE HEATER

by Andy Ross

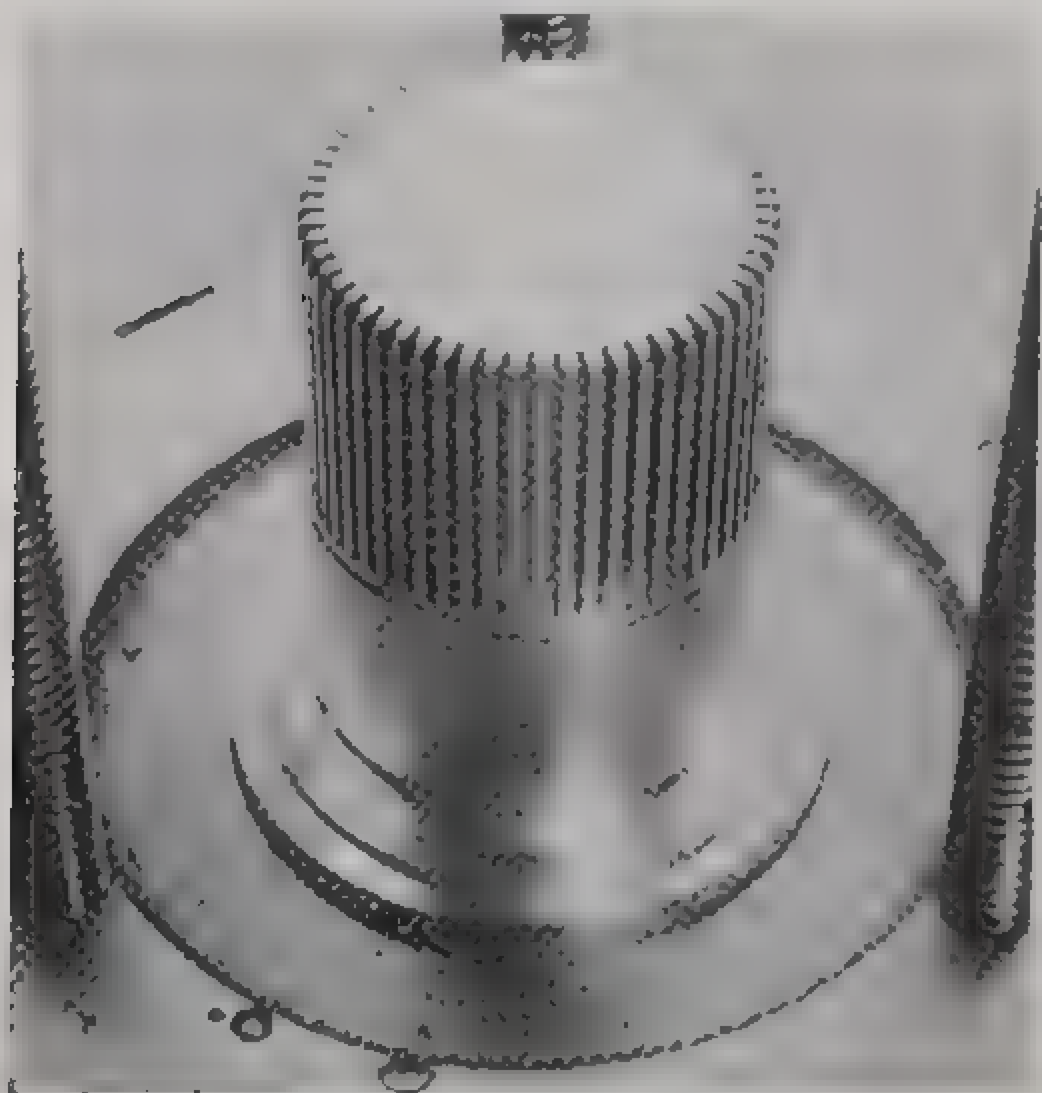
THE HEATER, OR HOT END, of a pressurised Stirling engine is certainly one of the most critical and difficult parts to design and make. All the heat going into the engine must be transferred from the flame, through the heater walls, and into the working gas. As the engine's working pressure is increased, the heat transfer into and out of the heater often becomes a limiting factor in performance, preventing power from increasing in proportion to pressure. Apart from good heat transfer, which generally requires a large surface area, the heater also must have sufficient creep strength and scale resistance to run continuously at red heat, and it must avoid excessive dead volume inside.

In my own modest programme of small Stirling engine development, I have long wanted to build and test an engine heater with extended surface area. The early Philips literature suggests attaching aluminium bronze fins, both inside and outside, to a stainless steel cylinder. The bronze is a good heat conductor, with a similar coefficient of thermal expansion to the 300 series stainless steels, and oxidation is apparently no problem. Attaching the fins, however, can be a problem. High temperature silver brazing may be one way, but my investigations indicated it should probably be done in a hydrogen atmosphere, after copper plating the bronze. Even then, the desired operating temperatures seemed dangerously close to the softening point of the bronze. On the whole, this approach seemed fraught with difficulties; I would still like to know exactly how Philips did it.

Tubes are another common way to meet the problems of heater construction. However, in practice, fins offer a much better ratio of cross sectional flow area to heater length, and this feature seems particularly useful in the small, medium pressure (100 p.s.i.) air engine, which is my main interest.

I recently tried to machine a finned heater out of Type 316 stainless, which has by far the best temperature creep strength of the commonly available metals; this was a disaster. Lack of machine rigidity

(only a small milling machine with high-speed cutters was available) made the work hardening trait of stainless an impossible obstacle. I should add that my design required welding a head onto the cylinder later, so the free machining stainless could not be used. In any event, machining the inner fins would have been difficult, even with a good machining material. Broaching, shaping, grinding and sawing, were all considered and rejected; which is not to say these methods could not work, but only that all presented difficulties or expenses that made them less than attractive. Electrical discharge machining would be ideal, especially with a moving wire electrode, but I hoped to avoid the time, trouble and expense necessary to build and test a working EDM machine. Shrinking or pressing an inner ring of fins into a cylinder of outer fins was considered and rejected (perhaps too hastily) for fear of not maintaining an adequate thermal bond, although there is enough difference in the thermal expansion coefficient of various stainless steels to make this still seem possible.



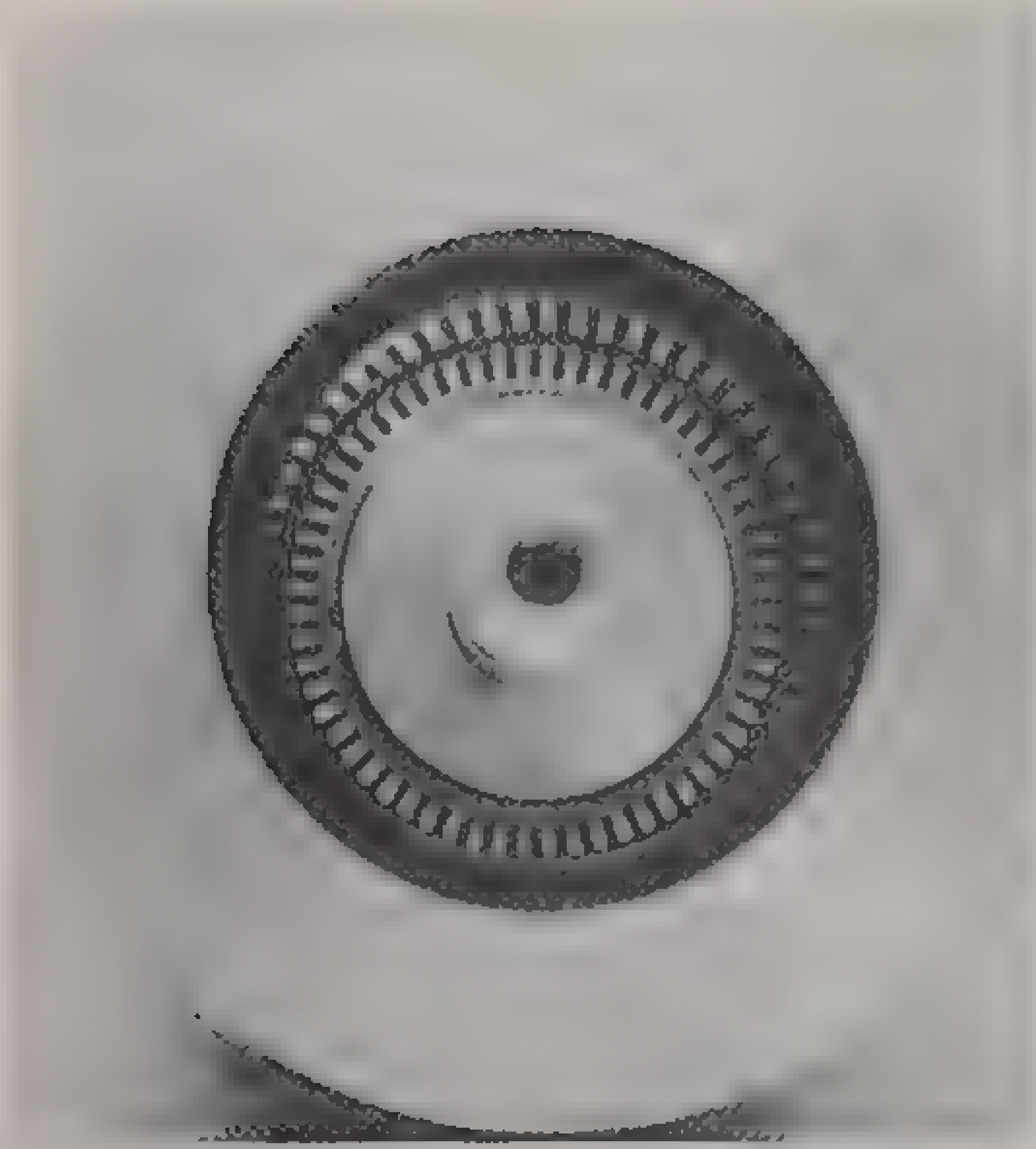
Inner portion resting on iron pedestal.

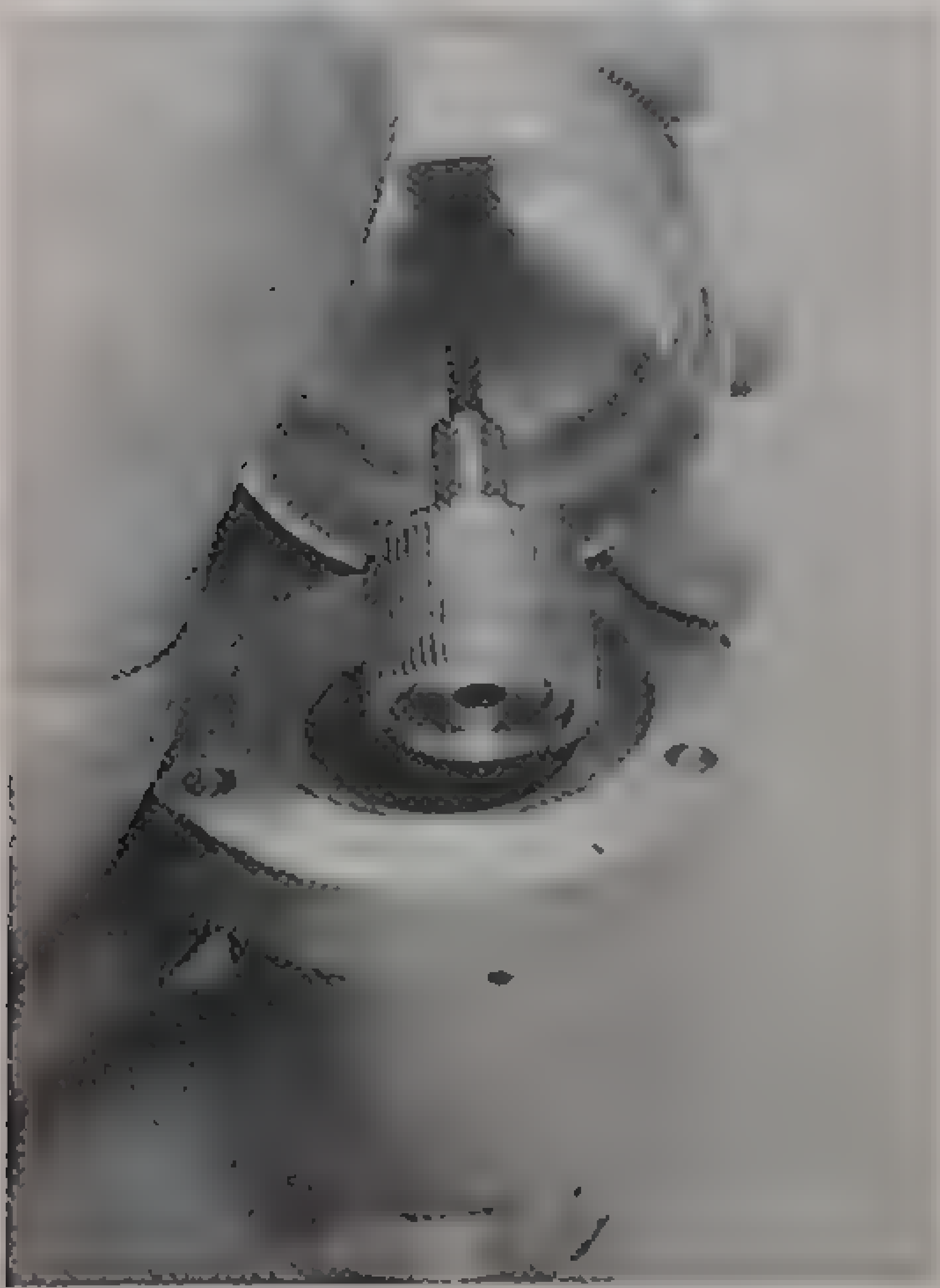
Finally, I considered the lost-wax (investment) casting process. My interest in this approach increased greatly upon learning that a small local firm regularly investment cast stainless steels, and that they were willing to cast my design for a reasonable price if I produced the wax patterns. I wanted internal fins .030 in. thick, .065 in. deep, with .020 in. slots, and they thought this should be possible.

I considered machinable wax, but decided to try to make a die instead, since one could not expect every pattern to produce a perfect casting, and machining pattern after pattern, even in wax, would be very tedious, indeed.

Top: Slots for fins and dowel pin plunger. Bottom: Fully assembled die.

I had some years ago made a two-part open aluminium die for producing wax patterns for locomotive drivers. It had large draft angles, and had given no trouble. The patterns were subsequently commercially cast in brass, and turned out





Top: Bottom of die removed — note fins.
Bottom: Inner finned portion removed by screw.

beautifully. But a Stirling heater was different. A closed die was required, and the large surface area of the fins made one suspect that proper release was going to be a problem.

My first experiments were to determine what material to use for the die. Aluminium requires the use of a release agent, otherwise wax sticks to it. The release agent (I had formerly used liquid detergent) could reduce detail pick-up if applied too thickly, and I originally hoped to avoid using it entirely by making the die out of slippery material, like Delrin plastic, or Teflon. Believe it or not, wax sticks to them very well too, especially in a finned configuration. Moreover, the Delrin even seemed to absorb the release agent, making it totally unsatisfactory for my purposes.

Ultimately, I decided to use aluminium, after obtaining good results with this metal by using a commercial silicone release agent which is available in spray cans.

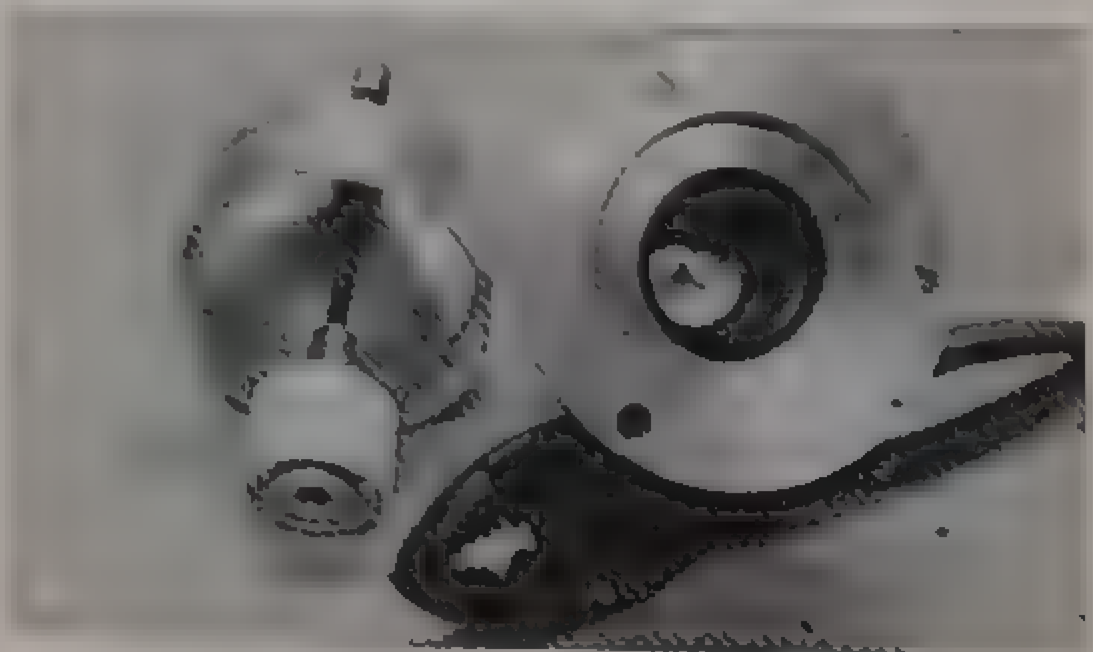
After experimenting on little finned blocks of aluminium with various waxes, I chose regular dental inlay wax, primarily because it took up excellent detail without pressure. Nevertheless, there remained many potential problems. For example, since my die would have to have at least four parts, would special seals have to be employed to prevent wax leakage? Would pressure be required? If so, how much? Would the aluminium cool the wax too rapidly for proper filling unless the die was also heated? Would the release agent work on hot surfaces? Because I didn't know the answers to any of these questions, I decided to make a smaller heater first. If the project turned out to be impossible, at least I would not have wasted as much time and effort. If the project was successful, I would use the first heater as experience for confidently designing the heater I really wanted. Thus, I would not have to guess at metal contraction values, or wonder if porosity would be a problem, etc.

In light of the interest in *Model Engineer*'s 5 cc. hot air engine competition, an initial design for this size engine seemed ideal. Several friends were building such engines, and perhaps they would incorporate my heater on their engines, and later furnish me with test results. This would save immense time and effort, and so was irresistible.

The photos show the die I finally made. It is all aluminium. The inner portion is made in three parts, easing the release problems.

I initially tried to pour hot wax through the hole in the top to fill the die. The wax froze too soon and

Poppet valve remains in the wax pattern.



proper filling was impossible. What did work was to fill the cavity with wax, then plunge the top portion into it. Sealing proved unnecessary. The molten wax is very resistant to going through thin, cool gaps.

Removing the top of the die brings away the pattern. Pushing plunger releases pattern.

The pattern ready for investment.

Release, however, was a problem. This die has no draft at all, and when the release agent stays on the metal it works well; however, it seems that the hot wax will rinse off the agent if poured over the metal for any length of time. I found I had to shield the inner fins with aluminium foil when pouring wax in the cavity, to avoid this rinse effect on the most critical part, the inner fins, which present over seven square inches of surface area.

The top of this inner finned unit is separate, like an inverted poppet valve, permitting it to stay in the pattern while the finned part is extracted. This is important since it tends to stick. Initially it was made to come out with the finned portion, but often it would pull out chunks of wax with it, or alternatively, extrude the wax pattern through the necked-down portion of the outer cylinder. In a subsequent arrangement, a screw pushed the finned portion away from the "poppet valve" top, but this would too often simply push the top off the pattern. In designing a wax die, one must always be careful to provide sufficient ridges or undercuts at appropriate places to hold the pattern and resist the forces imposed during release.

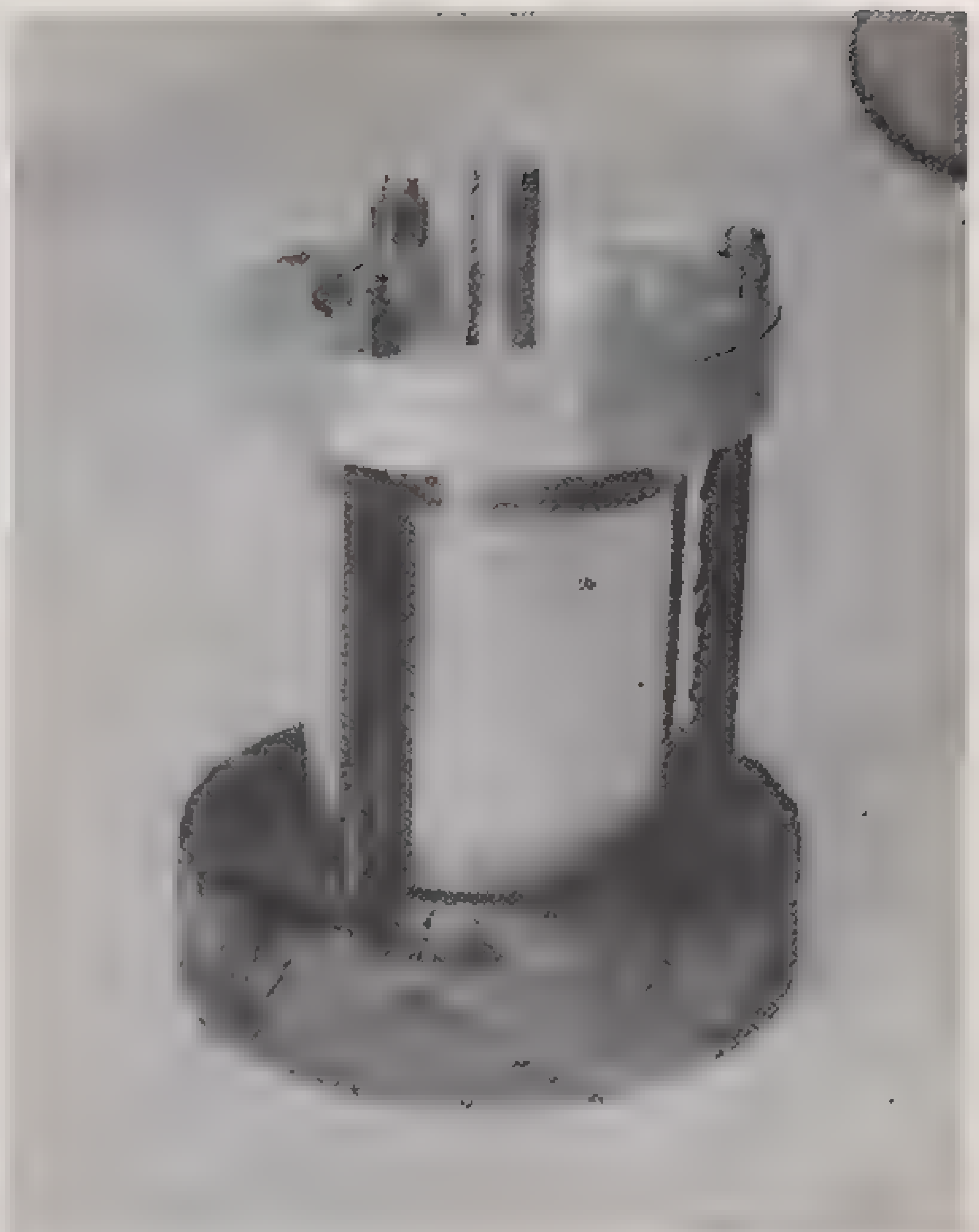
Pressure turned out to be necessary to reliably pick up the fin detail, but it also turned out to be easy to obtain by merely leaving a reamed .375 in. hole in the top of the die, and applying a plunger through that hole into the still-molten wax.

Early efforts with the die produced one good pattern out of six tries, but I now get five good patterns out of six. A description of the technique will perhaps be useful.

I first clean the die of any residue of the last use, and spray it with silicone release agent, taking particular care to thoroughly coat the trouble spots. The die is then partially assembled, leaving the top off, however. A piece of aluminium foil is arranged in the die cavity so as to shield the inner finned member and its top from the hot wax during initial pouring. The wax is thoroughly melted, and poured

The pattern cut away to show inner and outer fins and cylinder wall

in the cavity, and the shield is removed as the wax covers the fins. The top of the die is then immediately pushed into position, and hot wax overflows through its plunger hole. The ring clamp is then quickly fastened down, finger tight. At this point the overflowed wax is almost solid, but wax in the plunger hole remains molten. The plunger is then fitted into the hole, and pushed and held firmly, for about 30 seconds. I am probably applying 20 or 30 pounds pressure to it, so the internal pressure is high, probably around 250 p.s.i. or so. Too much pressure makes release difficult, too little makes detail pick-up poor (incomplete inner fins, generally). The plunger moves about ½ in., and the wax motion inside tends to (I believe) move the release agent off the inverted "poppet valve" top to the inner fins.



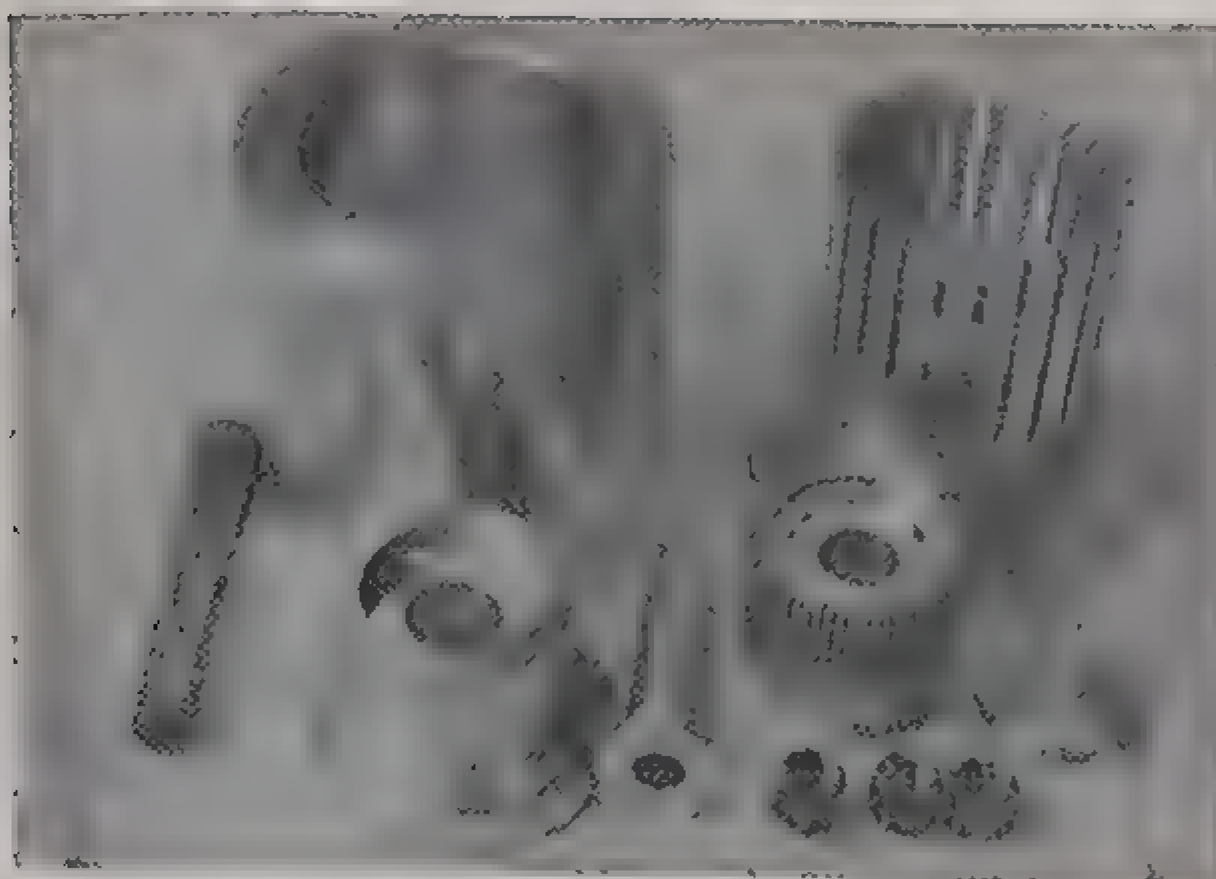
Fully assembled die with plunger.

After five or ten minutes the die can be taken apart. The bevel in the top portion eases removal. I move it enough simply to free the pattern, then I completely remove the bottom, which usually comes out very easily. I then use a screw extractor device to pull the inner finned member out. It comes out easily after the initial tug. If the inner fins are well formed, the pattern will usually be perfect. The poppet valve sticks to the top, and I simply leave it there for the time being.

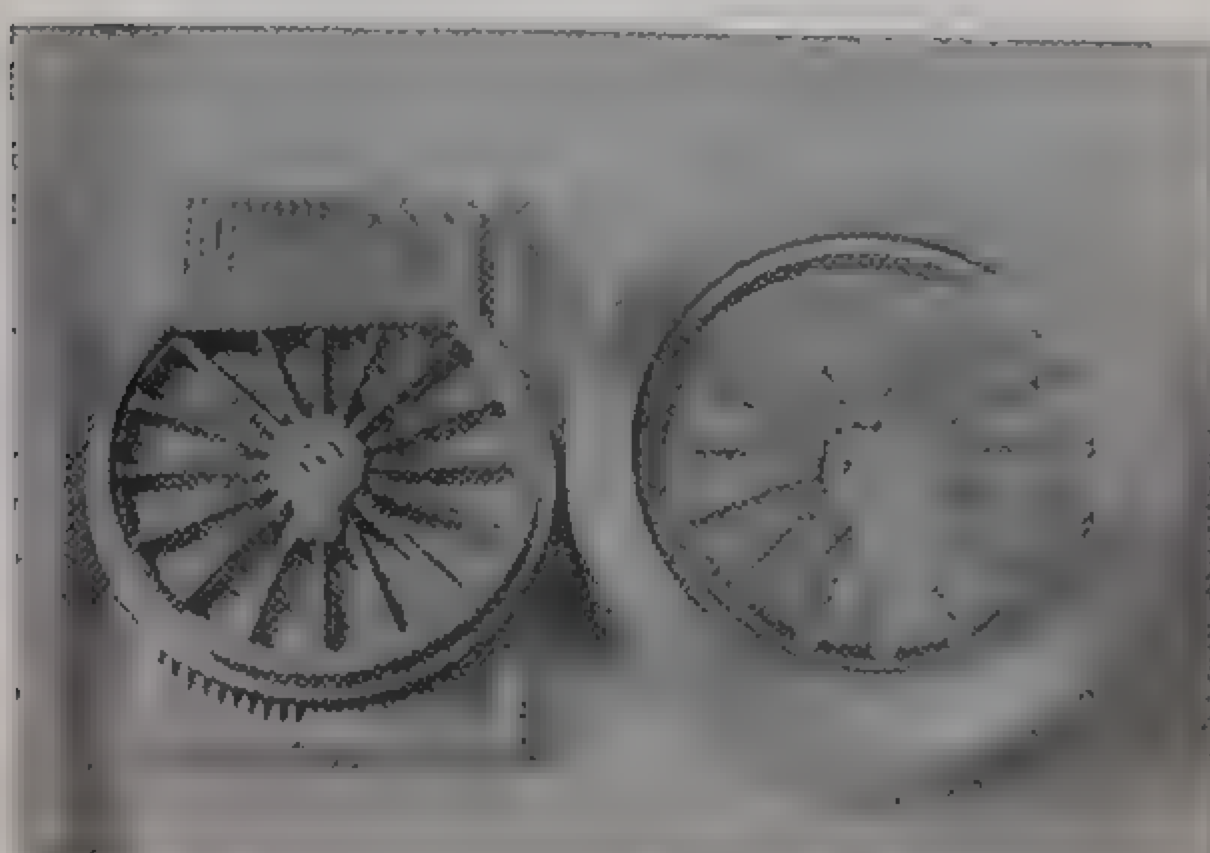
Next, I remove the top and the pattern comes with it. The plunger then serves to push the pattern from these "external" fin slots, usually with no difficulty, though if the wax is still soft it is possible to push through the top of the pattern. This is a very frustrating way to ruin a perfect pattern!

There remains only the "poppet valve". I put the pattern in the freezer for a few minutes, and the poppet valve usually comes out very easily, perhaps because differential contraction loosens it. The pattern is then ready to be sprued and invested.

Having obtained perfect wax patterns, I naturally thought my troubles were over; but they were just beginning! The local casting firm tried casting several patterns in stainless, and the results could be considered encouraging only by a never-say-die fanatic like myself. The inner fins, of course, were the problem; they had filled very well, but many of the spaces between them had also filled.



Die completely assembled.



First wax pattern die made on a Unimat eight years ago.

Close inspection with a magnifying glass revealed that the metal blobs between the fins looked very much like filled air bubbles, and some were even surrounded by ceramic investment. It seemed as if the first coat of ceramic slurry was keeping to the pattern, but that subsequent coats had air bubble inclusions which the molten metal broke into and filled.

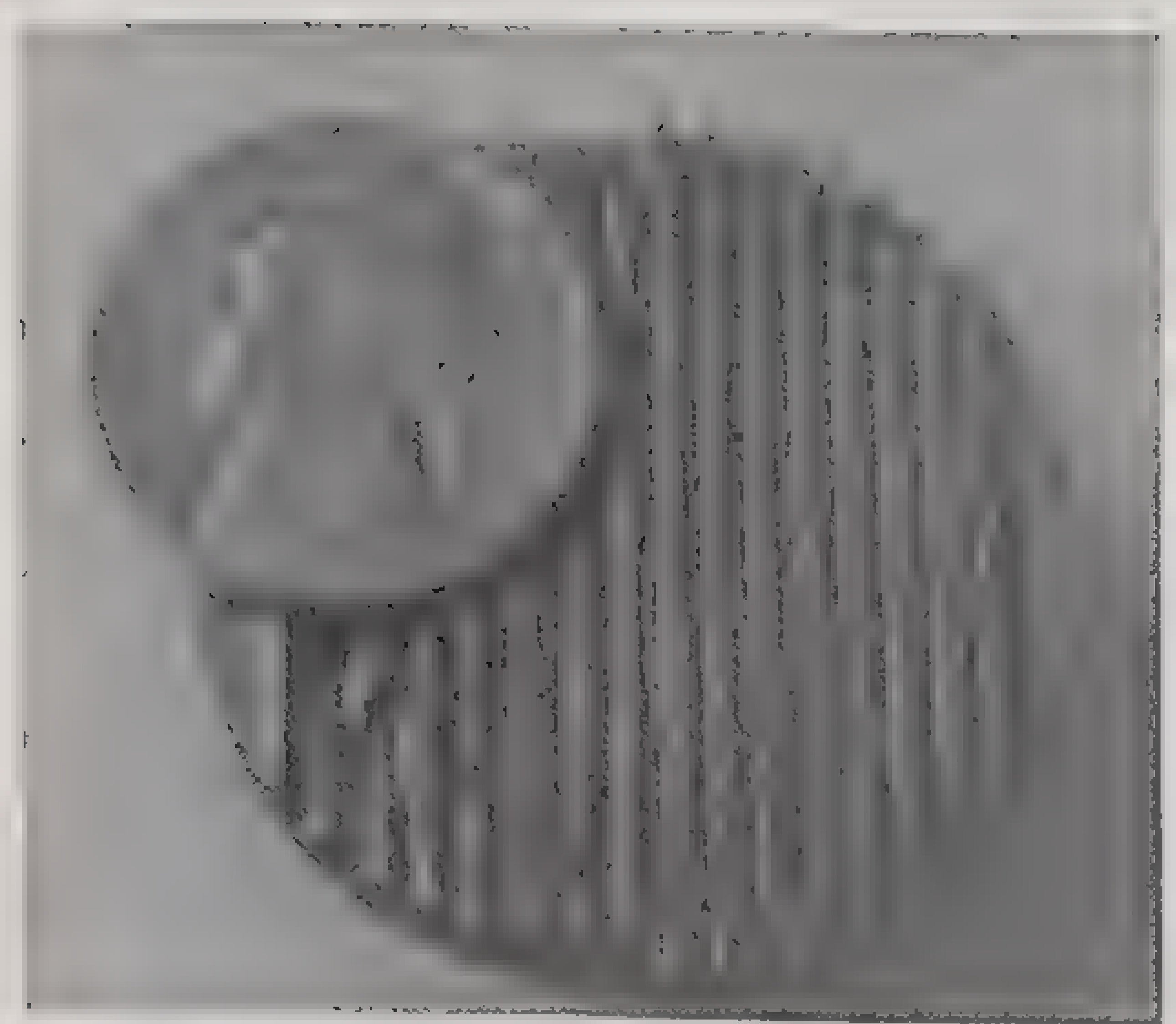
For further experimentation, I hastily made a simple two-piece die to produce wax wafers with slightly larger (.030 in. and .035 in.) fin slots. One of these wafers was cast in stainless, and the imperfections clearly appeared as filled air bubbles. (The gaps in the fins visible in the photograph were caused by use of an imperfect wax pattern; this in no way affected the experiment.)

We then decided to invest the heater heads using standard dental techniques, rather than the dip process. However, the local dental labs had no interest in the project, so I wrote to a large ceramic powder supplier to purchase the powder to do the job myself. Much to my delight, the supplier took an unexpected interest in the project, and sought waxes to see if they could successfully cast them in stainless. These were supplied, but we have yet to get satisfactory results.

Stainless steel casting showing bubbles in fins.

In the meantime, I decided to send some waxes to the brass investment caster who had done my driver castings eight years earlier. The resulting brass castings were inexpensive and extremely beautiful. The inner fins were perfectly formed, and, with the exception of several damaged "samples", there were no serious air bubble problems. Castings were promptly sent to friends who, it is hoped, will experiment with them in 5 cc. Stirling engines. Brass will not have sufficient strength for continued use at the desired temperatures, but the anticipated experiments should at least show whether the finned heater is worth pursuing further.

I have now located a wire EDM machine in Dayton, Ohio, and I plan to modify the die to leave the top of the waxes open and the inner fin section solid; these patterns should present no problems casting in stainless steel. The slots will then be made by the wire EDM, if it can be done for a



Stainless steel wafer to avoid blockages.

reasonable price. This way, at least, my Stirling project can go ahead at "full temperature" while the techniques of investment casting are investigated further. If any reader is an investment caster of high temperature alloys, and is looking for an interesting challenge . . . !

But all this gets away from the main point of this article, which is merely to describe a successful wax pattern die. Other model engineers may want to use this fascinating lost-wax process to produce multiple precision parts for their own favourite projects, and I hope this article will enable them to approach wax-pattern making with more confidence and knowledge than I had.

Sample brass casting from damaged pattern. The bubbles were later eliminated.

Inner fins of one of the good brass castings.

The supplier of ceramic investment powder that took an interest in the challenge presented by my wax patterns was The Ransom & Randolph Co. of Toledo, Ohio. I have no connection with this company, but I am extremely grateful to them (and particularly to Mr. Jack Griffin of that company) for their assistance. After overcoming various early difficulties, they have at last succeeded in making perfect castings in type 316 stainless steel from my waxes. One of these castings is on my desk before me now, as I write. It is in every way as finely detailed and as accurate as the earlier castings made in brass.

I will be going to Toledo very soon to learn the successful technique in detail; but basically they used a new ceramic powder, invested the waxes in flasks under a vacuum, and cast the metal with a vacuum assist on the investment. You can imagine how pleased I am to be able to report their success.

'HOLMSIDE'

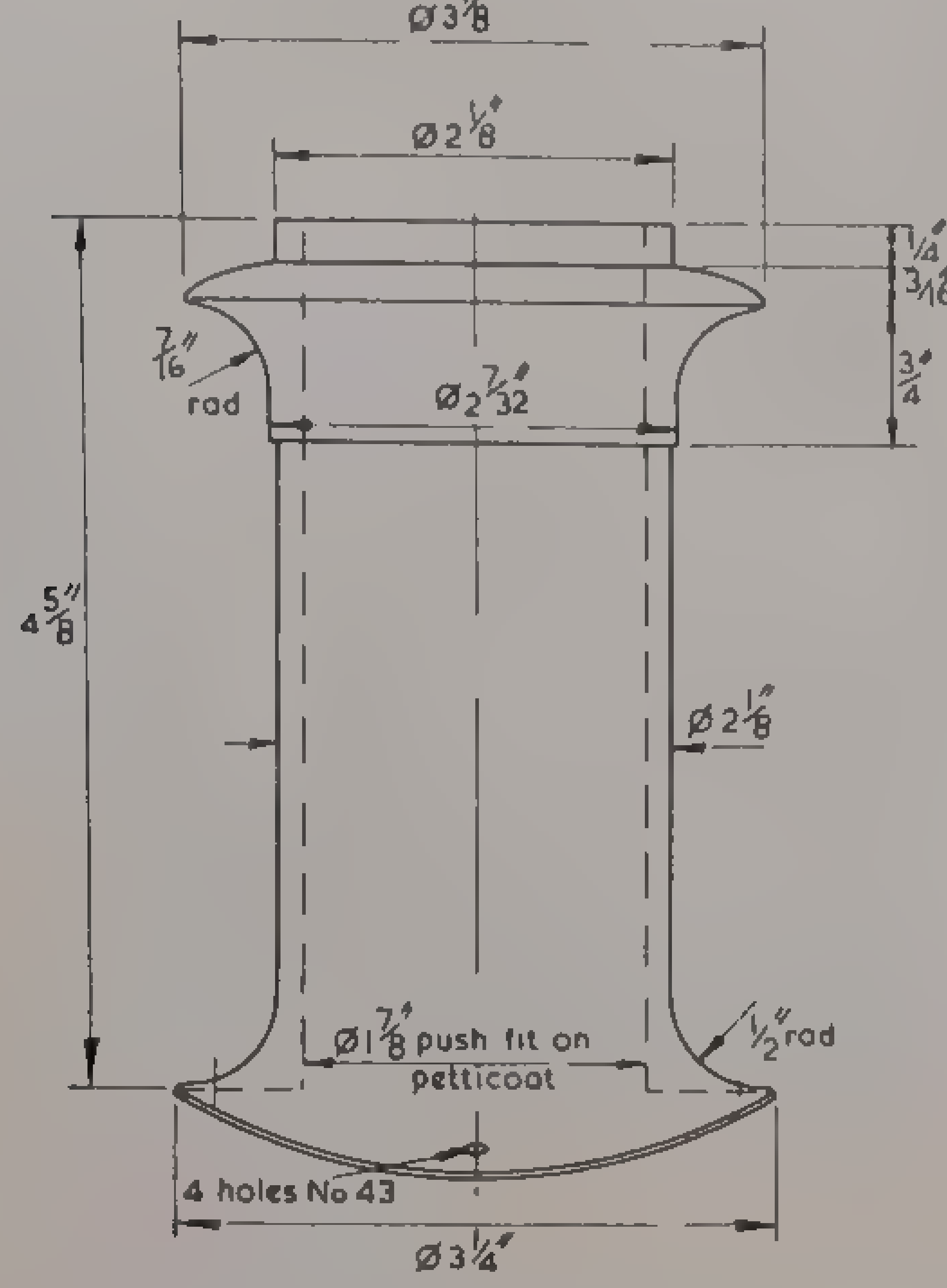
A National Coal Board Saddle Tank Locomotive for 7¼ and 7½ in. gauges

Part XIII

by Martin Evans

From page 505

CASTINGS should be available for the chimney and dome for *Holmside*; although the latter could be built up from sheet metal by builders who are skilled in this type of work (not your present writer, I'm afraid!).



CHIMNEY

The machining of these castings may present a bit of a problem for users of small lathes. The underside is generally fly-cut in the lathe, and in the case of the chimney, where the radius involved is 3¼ in., there should be no great difficulty as far as the flycutter itself is involved; it is the question of holding the casting which may cause some thought. My usual way is to first chuck the chimney in the four-jaw, and finish machine the bore — in this case to a nice tight hand push fit over the petticoat pipe (which is 1⅞ in. dia.). We now have to find something in the way of round bar or tube on which the chimney can be mounted. Possibly some builders may have an odd piece of 2 in. steel tube, which can be turned down to 1⅞ in. Or perhaps a short length of that thick-walled copper tube used for boiler firehole rings may be available. This would in fact be ideal, as the chimney could be a push fit on this and additionally secured by ordinary soft soldering for the flycutting operation.

Owners of Myford lathes, or any lathe of around 3½ in. centre height, will not be able to clamp the bar or tube mentioned above directly under their toolholders, even if the clamping "post" is long enough, as this arrangement would put the centre-line of the chimney above centre-height. The bar or tube must therefore be brazed to a piece of flat bar (something about 2 in. x ⅜ in. x 3 in. long would do nicely), the bar being clamped under the toolholder, with the chimney mounted outside the top-slide, on its left, the tube on which the chimney is mounted being of course of a length equal to the height of the chimney *plus* the 3 in. mentioned.

However, many builders will not think all this work to enable the flycutting operation to be carried out worth the time and trouble involved, so they will fall back on filing. It should not be too difficult to achieve a nice radius by filing, if the casting is continually "offered up" to the smokebox saddle while the filing is in progress. The important thing is that the chimney is quite square to the smokebox.

For machining the outside of the chimney, a similar piece of bar or tube may be used, and the shape required should not be at all difficult if two tools are used, one a normal parting-off tool, ground quite square on the cutting face, and another, similar to a parting tool, but with both corners well radiused.

In this scale, it might be advisable to bolt the chimney down to the smokebox, rather than rely on a push fit only. In this case, four 8 BA hexagon-head screws (those with 10 BA size heads for preference) should be ample, evenly disposed around the base.

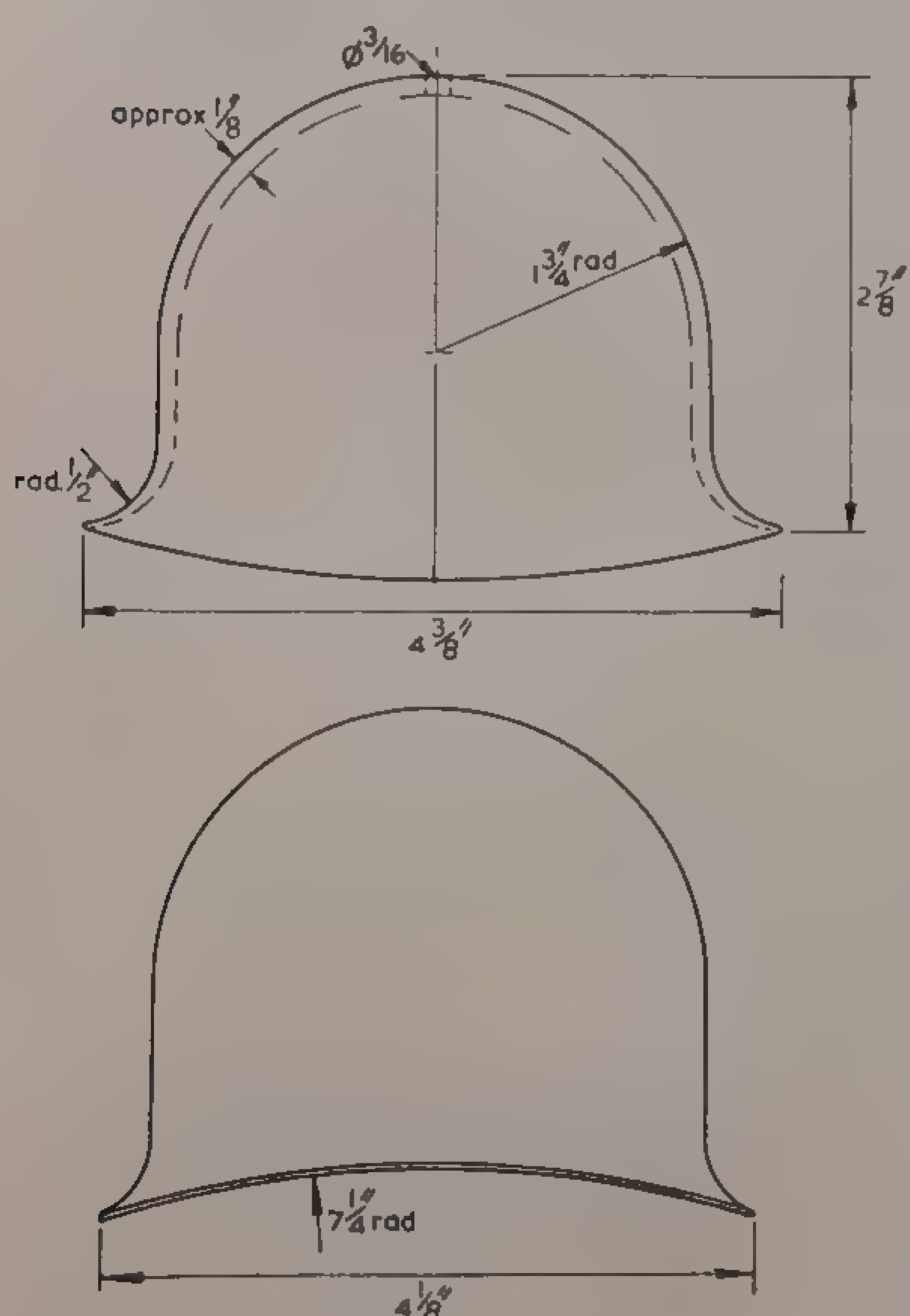
Builders who would like their chimney to have the copper cap (as on the original engine) might consider having the whole chimney copper plated. Another solution would be to make the top part of the chimney quite separate, and turned from copper. I very much doubt whether it is possible to obtain copper tube anywhere near the diameter and thickness for this, but square or rectangular copper bar might be used, bent into a circle with the joint

silver-soldered. The joint would not show much if the copper cap was arranged with the joint to the rear. Again, it sounds a great deal of work for a small improvement!

The Dome

When we come to the dome, we are faced with an underside that has to be no less than 7¼ in. radius, which I think rules out flycutting altogether. So this surface will have to be filed. To machine the inside, the usual way is to drill the 3/16 in. dia. hole in the top and bolt the casting to a temporary chucking spigot, say a length of brass about ¾ in. diameter. It can be soft soldered in addition. The inside is then finished, the chucking spigot melted off and re-mounted on the inside, while the outside is finish machined. Another way of dealing with the dome is to fit the chucking spigot to the inside first, and machine the outside. The dome can then be held in the three-jaw chuck, for machining the inside, if something soft is put between the chuck jaws and the machined surface to avoid marking it.

The dome can be held down to the saddle tank by a single 2 BA hexagon-head screw into the tapped hole in the top of the regulator body.



DOME

Running Boards

Some more "plate-work" now. For the running boards, we shall need some nice flat mild steel 1/16 in. thick. Brass would not be strong enough in this scale, and would be rather expensive anyway. There are no bends in these running boards, and the angle edging (valance or hanging-bar — call it what you will!) is very simple, being made from ½ in. x ½ in. x ⅛ in. brass angle, with separate pieces of brass sheet of ¼ in. thickness for the ornamental ends which can be soft or even silver soldered to the angle and filed flush on the outside so that the join will not show.

A few slots and "cutaways" are required in the running boards. On the left-hand side, we need a slot to clear the driving arm of the mechanical lubricator, a narrow piece cut out to clear the boiler expansion angles, and if sand boxes are required, clearance holes for the pipes. There will also be the clearance hole and the wedge-washer for the hand-brake column, described on page 320, 17 March issue.

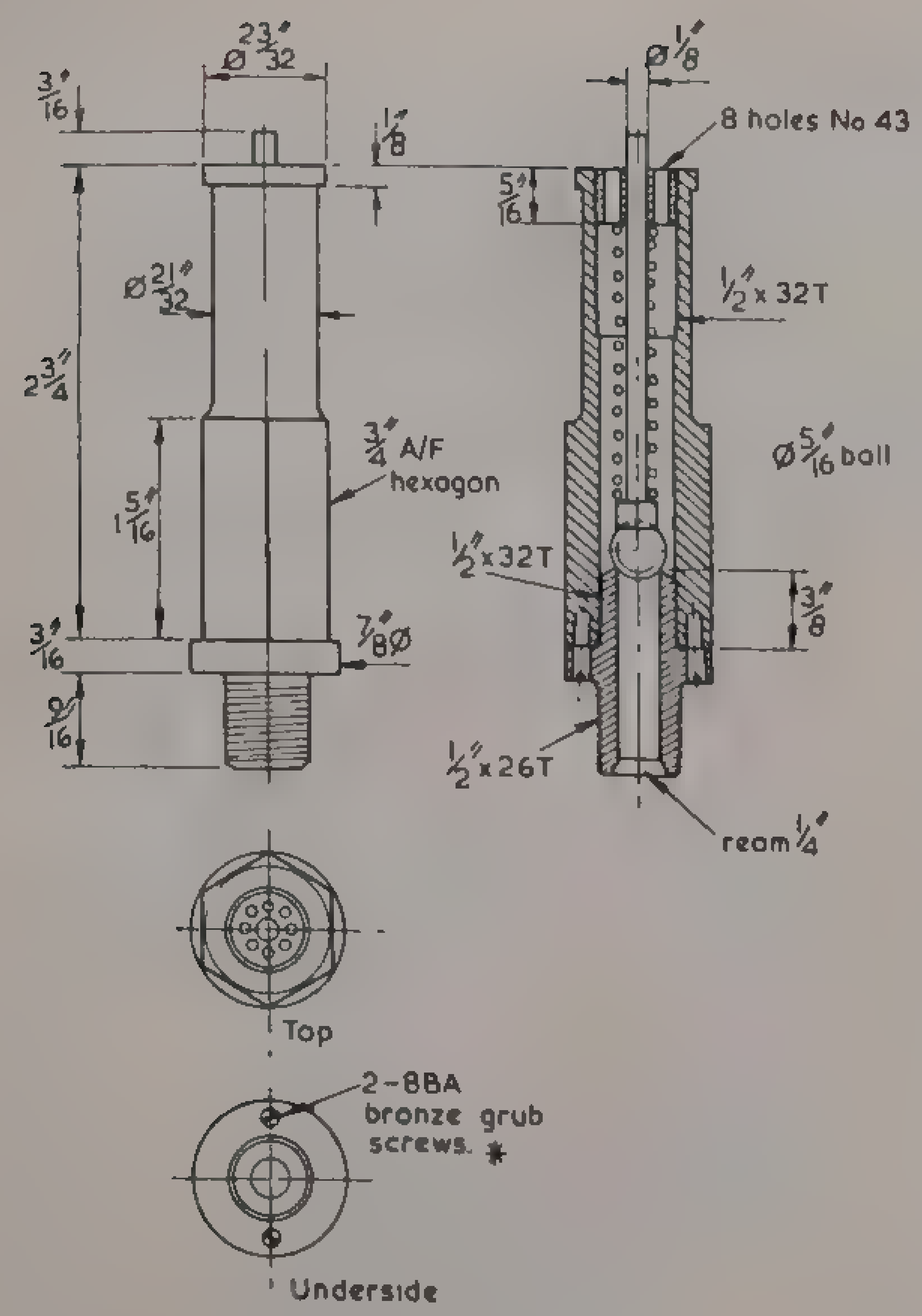
On the right-hand side, we will need a cutaway to clear the cab reverser and again a narrow piece cut out to clear the boiler expansion angles.

To secure the running boards to the frames, two pieces of steel angle are used; these are ½ in. lengths of 1½ in. x 1½ in. x 3/16 in., that nearest to the centre of the locomotive being cut away to clear the driving wheel. These angles can be flush riveted to the running boards, and held to the frames by 4 BA bolts into tapped holes in the frames. Additional support is given to the running boards by the motion plates, though I don't think it should be necessary to bolt them down here; 1/16 in. steel plate is fairly stiff material!

At the ends, small hexagon-head screws can be used to hold the running boards firmly, 8 BA for the outer hole, as there is only the thickness of the buffer beam here (¼ in.), plus two 4 BA nearer the frame, where we have the additional thickness of the 3/16 in. angles to drill and tap into.

Lubrication

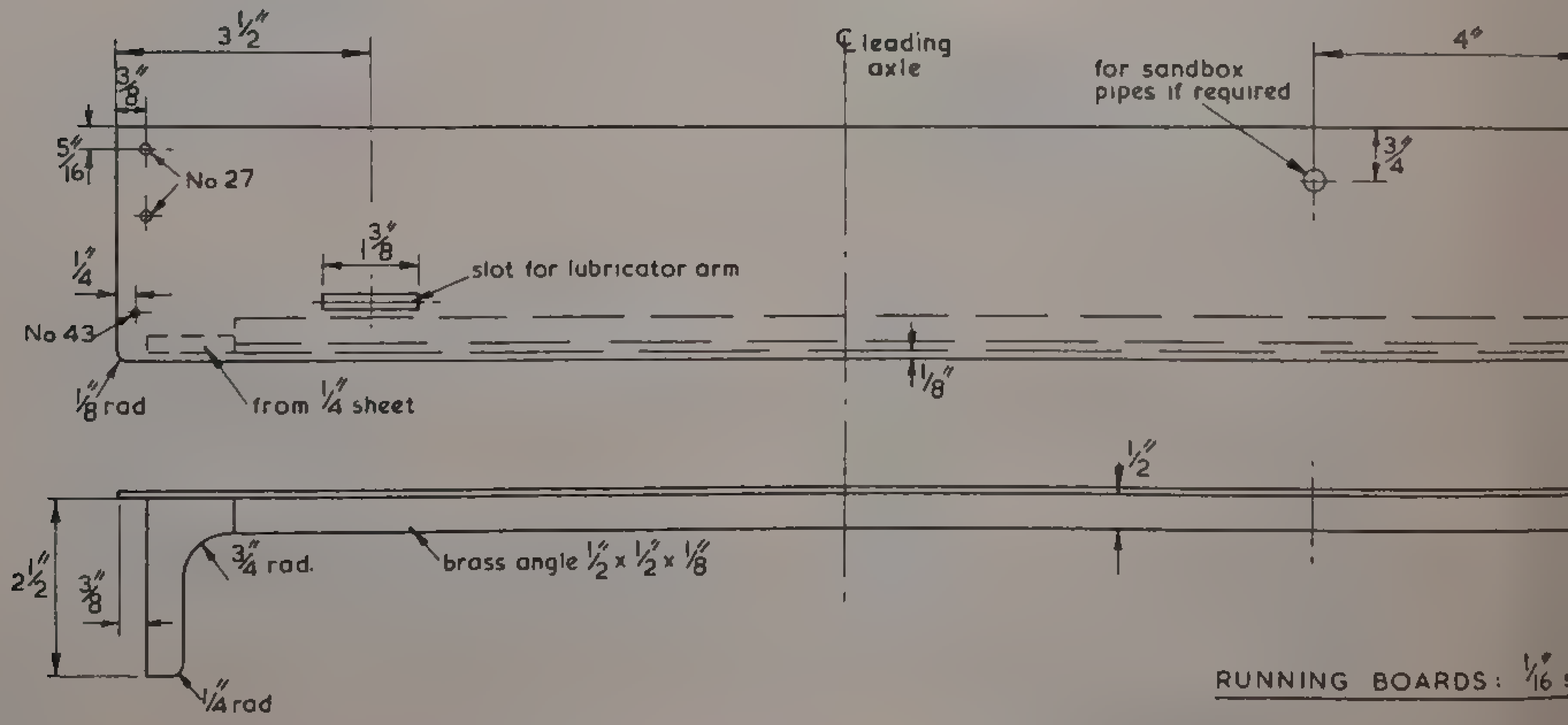
As I mentioned in my last article on *Greene King*, it is always a bit of a problem to know where to put the lubricator, if of the usual mechanical type. For a working engine, I certainly think the lubricator should be in a really accessible position, and well clear of dust and ashes. In ¾ in. scale, even one of the oscillating cylinder type in a tank 1 in. square looks rather an eyesore; which is why I suggested that the lubricator might be placed in the cab, and driven by a little return crank on the trailing coupled crankpin. But in 1½ in. scale, a running board-mounted lubricator does not look unduly large, so I decided it might be satisfactory for *Holmside*.



SAFETY VALVES: 2 off gunmetal

* These grub screws are essential to prevent the top part of the S.V. body unscrewing when the valve is being removed from the boiler.

The problem now was to arrange for a suitable drive. With inside valve gear, it would not have been easy to obtain a drive from one of the valve gear components, and if the crosshead is used, its stroke (3 in. in our case) has to be drastically reduced. Looking at some photographs of industrial steam locomotives recently, I noticed that several of the more modern ones were fitted with mechanical lubricators on the running boards driven from either the crosshead, or from a small return crank on the main crankpin. This was done by Hudswell Clarke, Nasmyth Wilson, Robert Stephenson & Hawthorns and possibly by other manufacturers. The reduction in stroke was achieved by a reducing lever, placed approximately halfway between the crosshead or crank and the operating lever on the lubricator. This idea did not seem very convenient on *Holmside*, so I have substituted a simple drive incorporating stops fitted on a rod parallel to the motion and connected directly to the lever on the lubricator. With this arrangement, the stroke given to the lubricator lever can be varied at will simply by adjusting the position of the stops. To allow for the slight angularity at the lubricator end of the rod, the sliding member attached to the crosshead is drilled out slightly larger than the diameter of the rod.

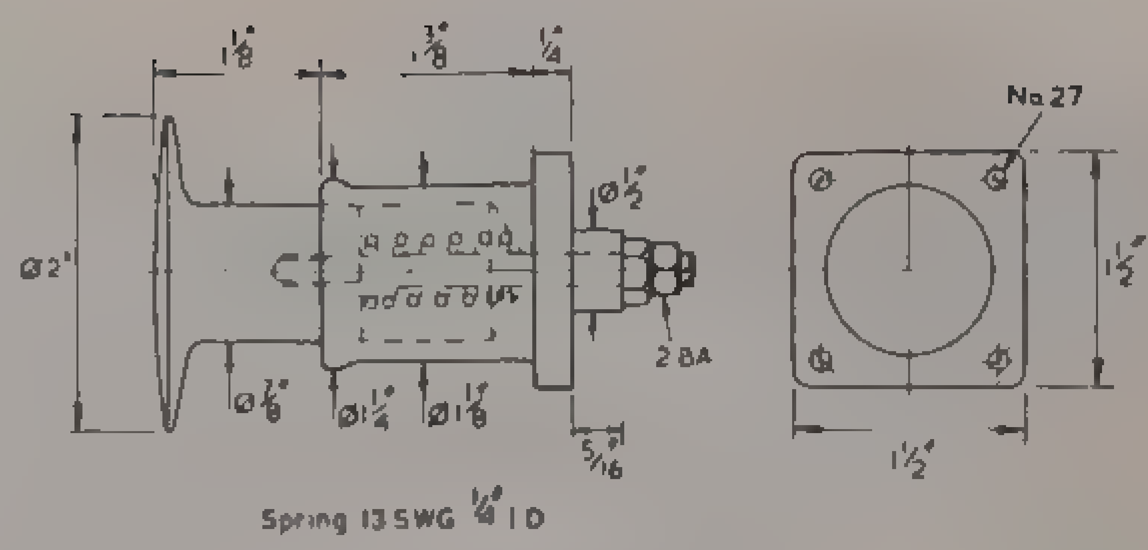


RUNNING BOARDS: 1/16 s

The lubricator shown is the M.A.P's LO.44 design, but an oscillating cylinder type may of course be fitted if preferred.

Boiler Fittings

The safety valves can be tackled next. On saddle tanks, the safety valves have to be made unusually tall. In our case, the valves are inserted through the oval hole in the tank, and to screw them home or remove them, a special box spanner will be required. I have shown the body of the valve in two pieces, as this enables the ball seating to be turned in the lathe. A one-piece body would have involved an unduly long D-bit or end mill, to machine the ball seating, which would not have been satisfactory. The lower part of the body is screwed into the upper part with a ½ in. x 32 thread. It is most important that the two parts do not become separated when unscrewing the valve, otherwise we should have the ball rattling about inside the "cavity" and it would be quite a job getting it out again, short of turning the whole locomotive upside down. To prevent this catastrophe therefore, two 8 BA grub screws, turned from gunmetal or phosphor-bronze, are inserted from below. They can be removed at any time, once the valve has been unscrewed from the boiler.

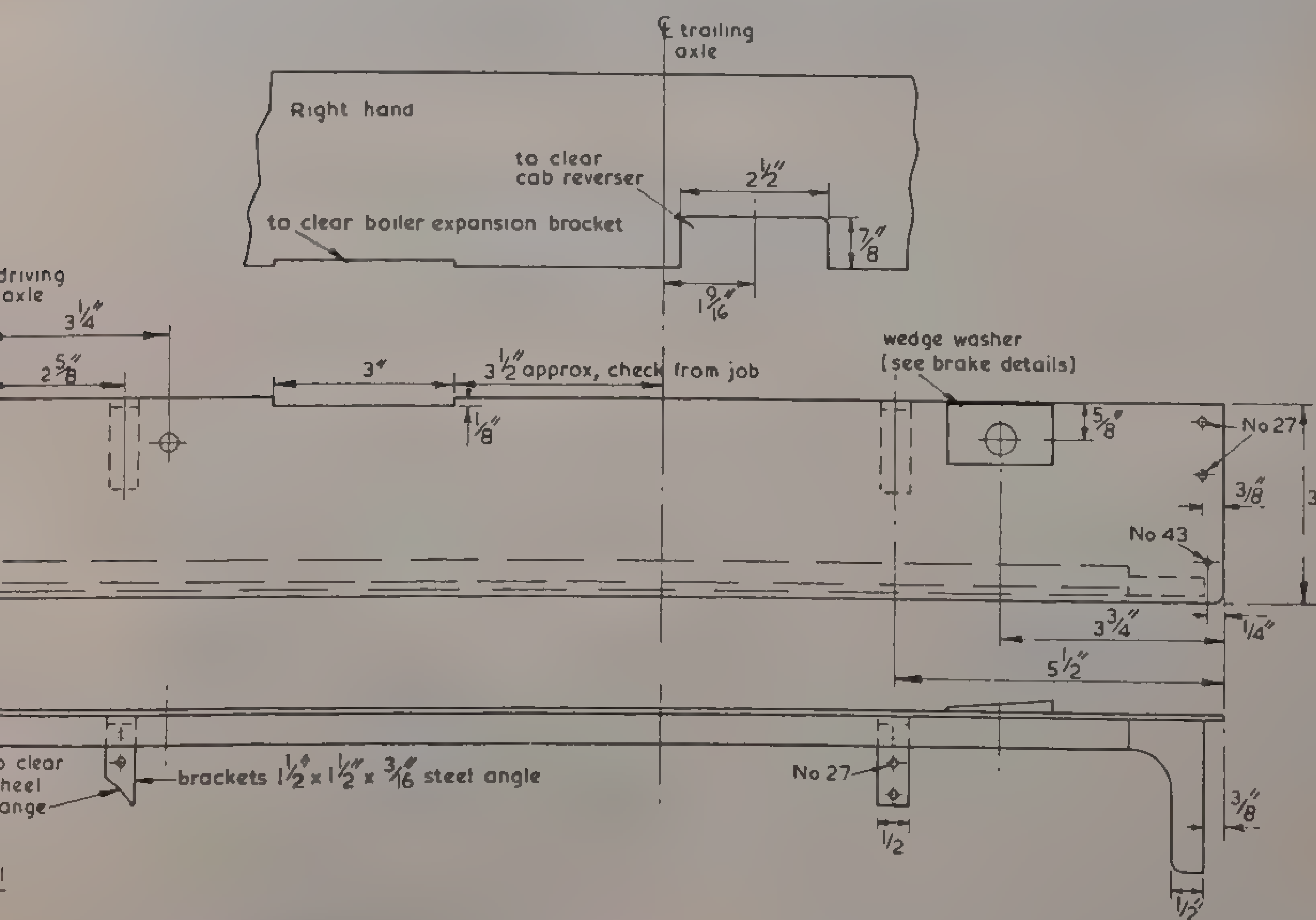


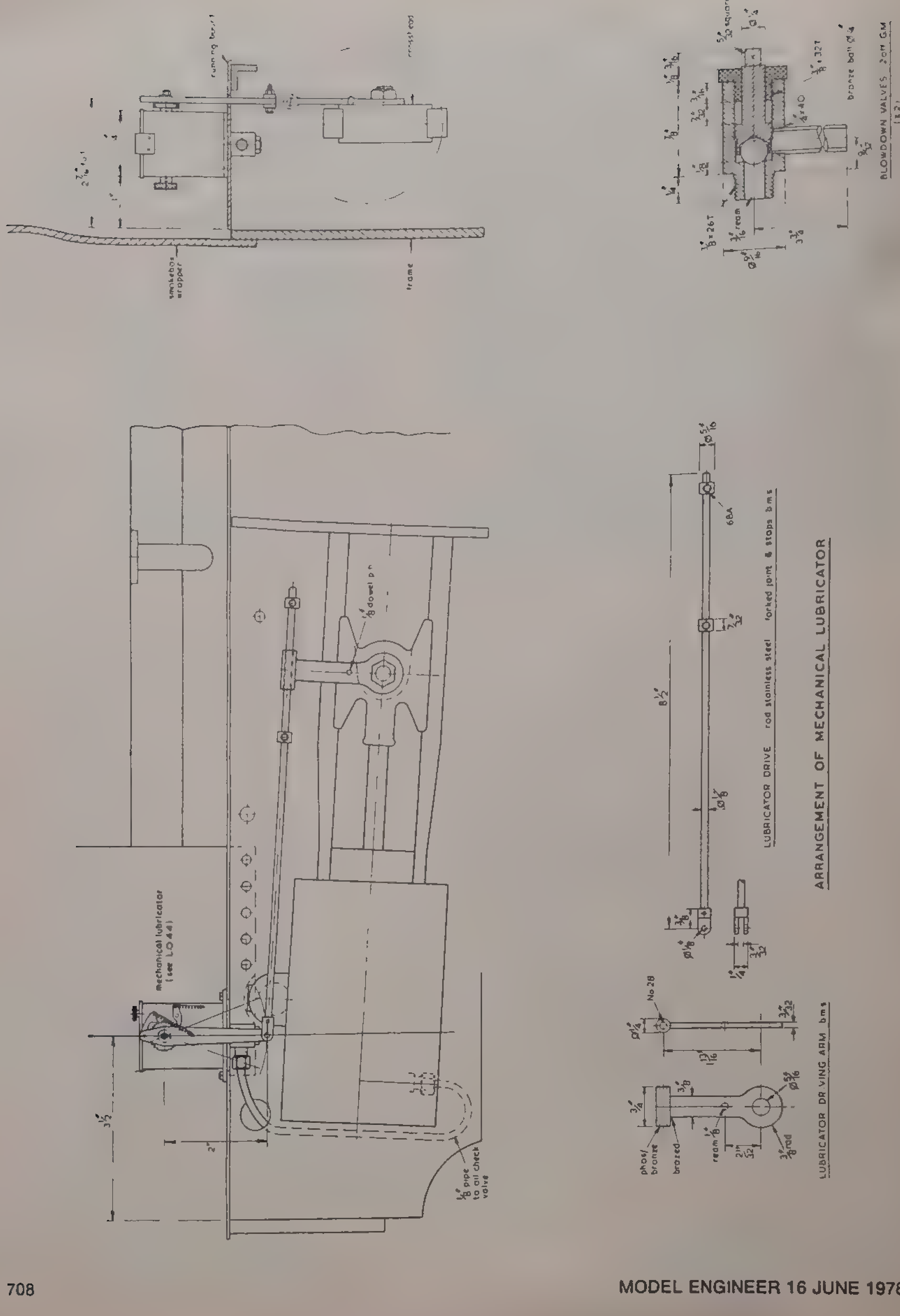
BUFFERS: 4 off bms

The blow-down valves are my usual revolving ball type, similar to those specified for various 5 in. gauge engines, but a little longer and larger in diameter. With the overall dimensions shown, they will comfortably clear the coupling rods.

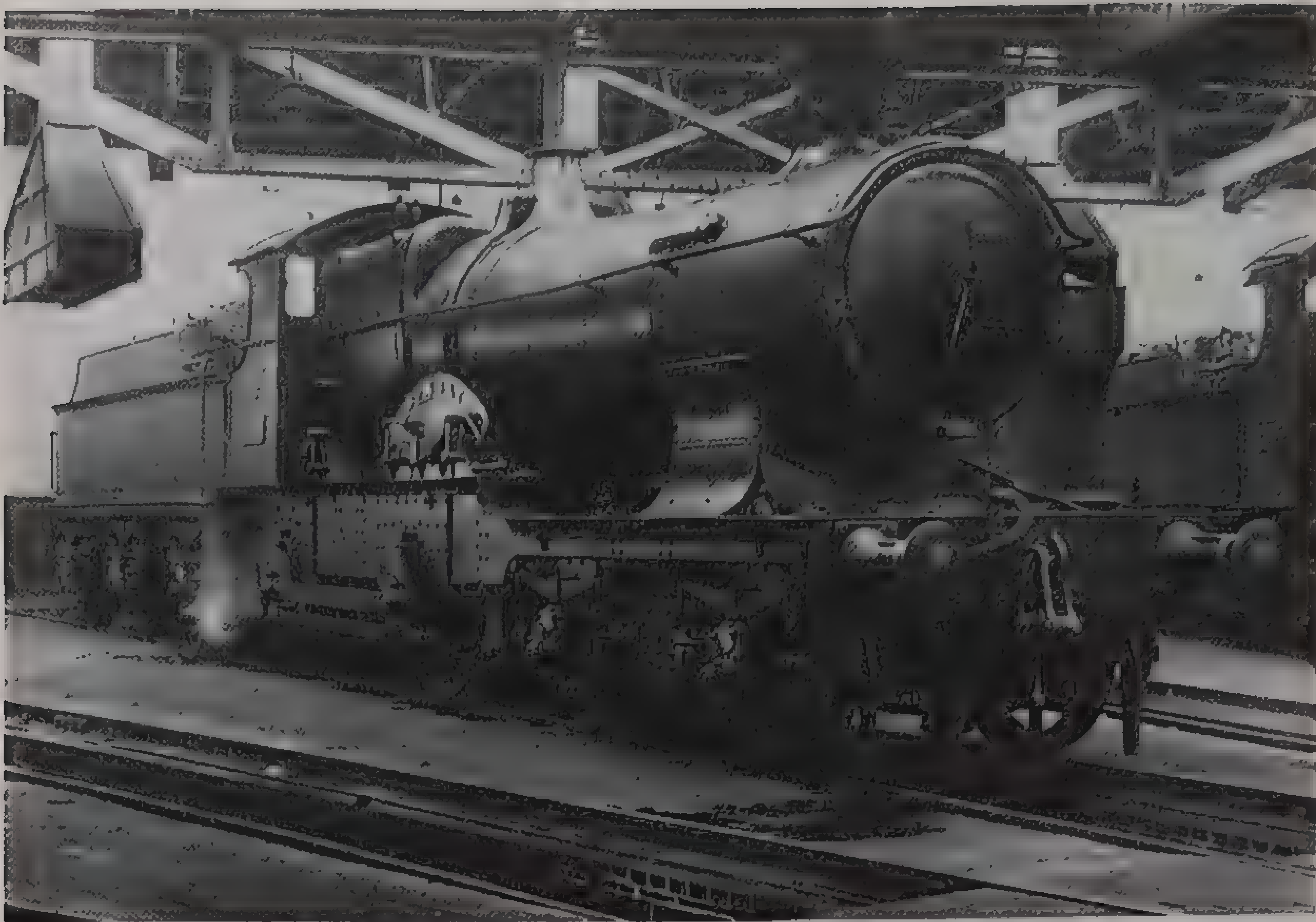
I do not think much need be said about the buffers, which are the same both front and rear. The heads are turned from 2 in. dia. free-cutting mild steel, and the bodies or stocks from 1½ in. square b.m.s. The stocks are made a good push fit in the ½ in. dia. holes in the buffer and drag beams, and four 4 BA hex-head bolts are used in each flange. Industrial type locomotives need strong buffers!

To be continued





ARRANGEMENT OF MECHANICAL LUBRICATOR



Photograph by courtesy of Len's of Sutton.

BULLDOG/DUKEDOG

A 5 in. gauge loco described by Keith Wilson

Part V

From page 584

Item 29. Main Frame Stay

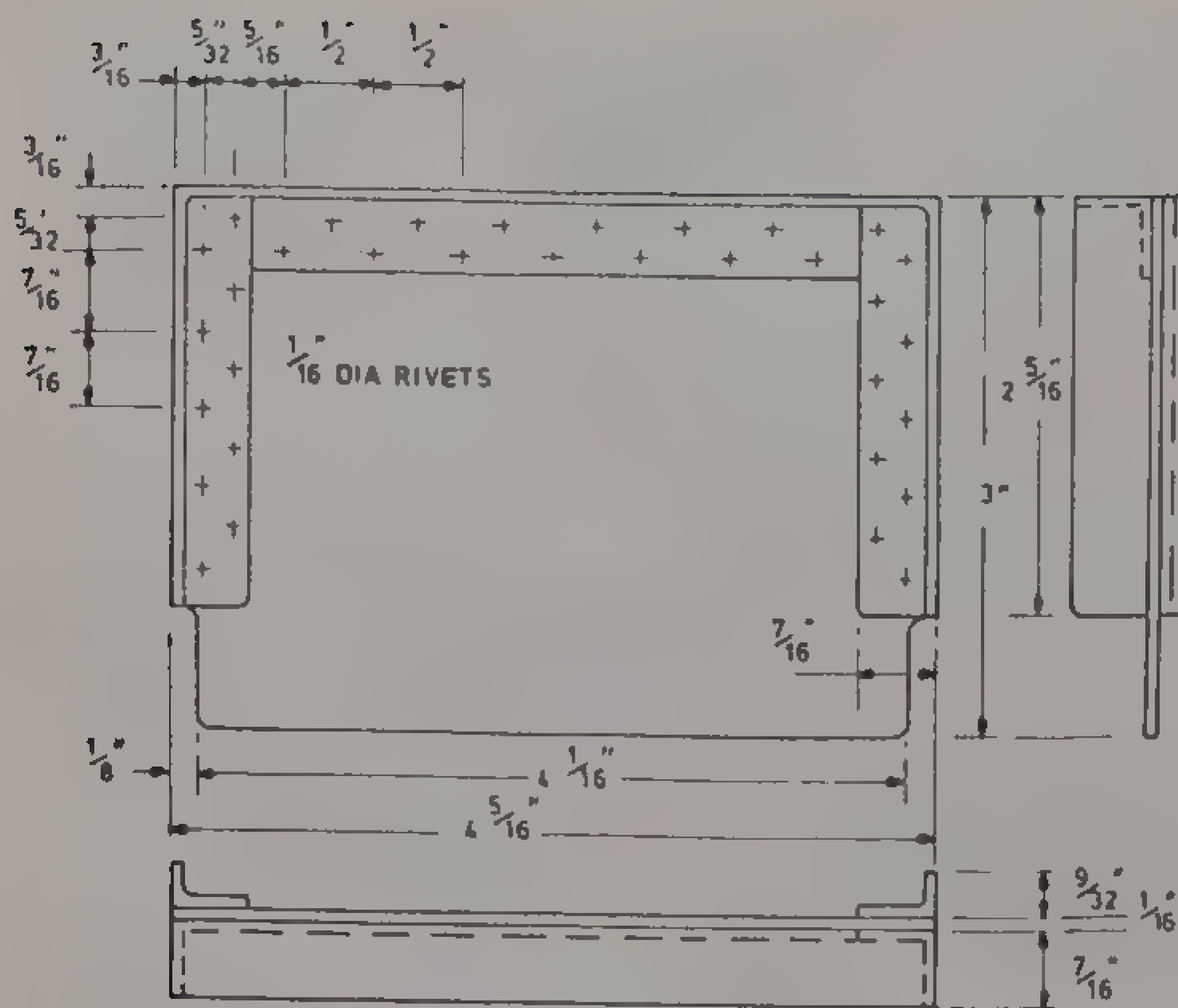
This is a straightforward piece to make. I have tried to get the rivet pattern right, but there is one small sacrifice to "working" as distinct from "scale". This is the part hanging below the bottom of the side angles — it has to be cut in at the ends to only 4 1/16 in. to clear the inner spring brackets. The hanging-down part will help to protect the motion from ashpan grit, ever an unwelcome guest. The angles for these brackets can be made out of brass angle (16 s.w.g.) or it is not too hard to form them in the vice out of 1/16 in. steel sheet. I have shewn a vertical joint between the top angle and the side angles, but frankly on the full-size loco I cannot decide just what was done — refer to photograph.

Item 33. Main Frame Stay

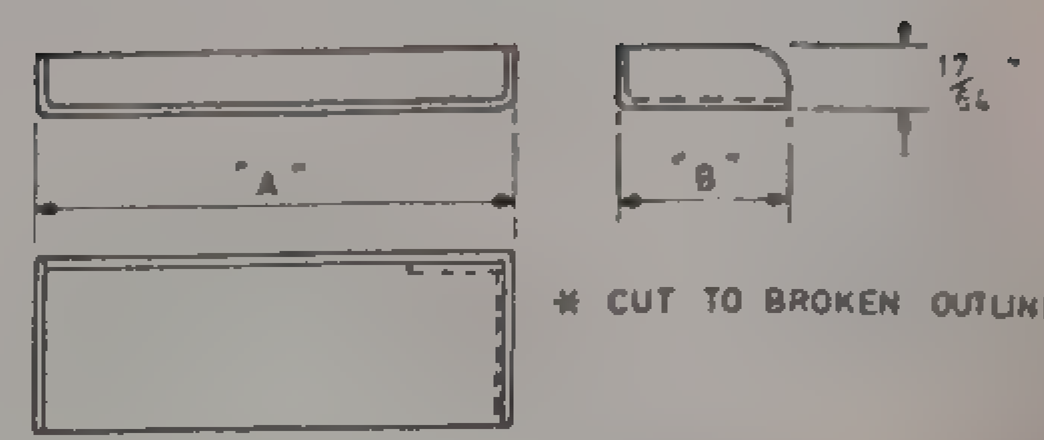
Much the same as item 29; another bit "not to scale" is the small piece of angle across the stay at 5/16 in. from the top. This is needed for the grate and ashpan fixing. It is one thing to "service" an engine when you can crawl underneath or even inside, it is less easy when you have to heave it around and generally grope in the darkness and get fingers burnt to boot. In both these items, get the rivets right as they just "miss" the rivets through the frames at each side. It is surprising how much easier this makes assembly.

Items 18-19-34-35. Steps

Anyone examining the official drawings from Swindon, of almost any loco, will think that these

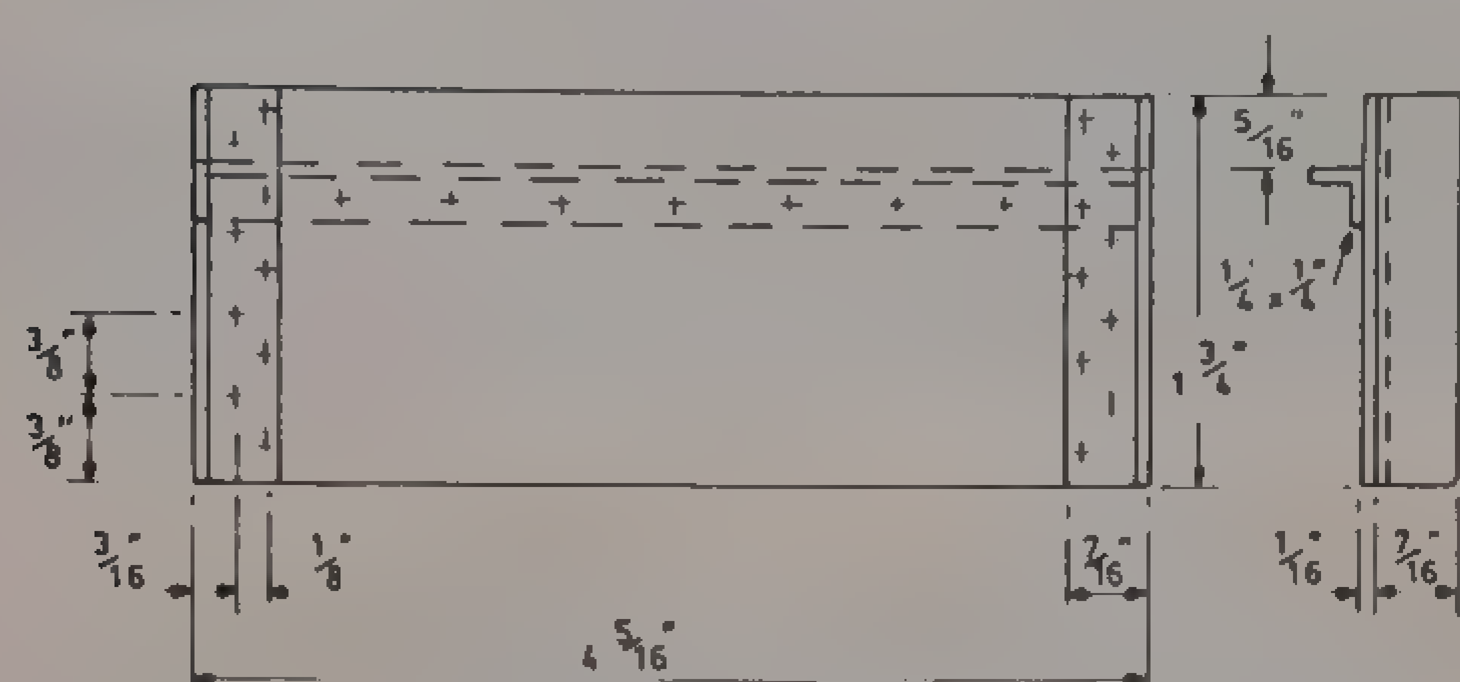


ITEM. 29 MAIN FRAME STAY
1 OFF MILD STEEL

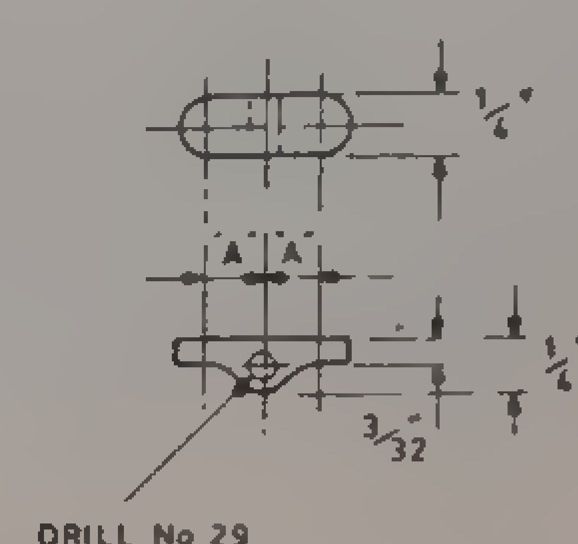


ITEM	POSITION	"A"	"B"	OFF	
18	FRONT UPPER	1 5/16"	17/32"	2	
19	FRONT LOWER	1 1/4"	11/16"	2	
34 R	CAB UPPER RIGHT	1 7/16"	11/16"	1	*
34 L	CAB UPPER LEFT	1 7/16"	11/16"	1	*
34	CAB MIDDLE	1 1/2"	11/16"	2	
35	CAB LOWER	2 1/8"	11/16"	2	

ITEMS 18, 19, 34 & 35 STEPS
MILD STEEL 20 SWG

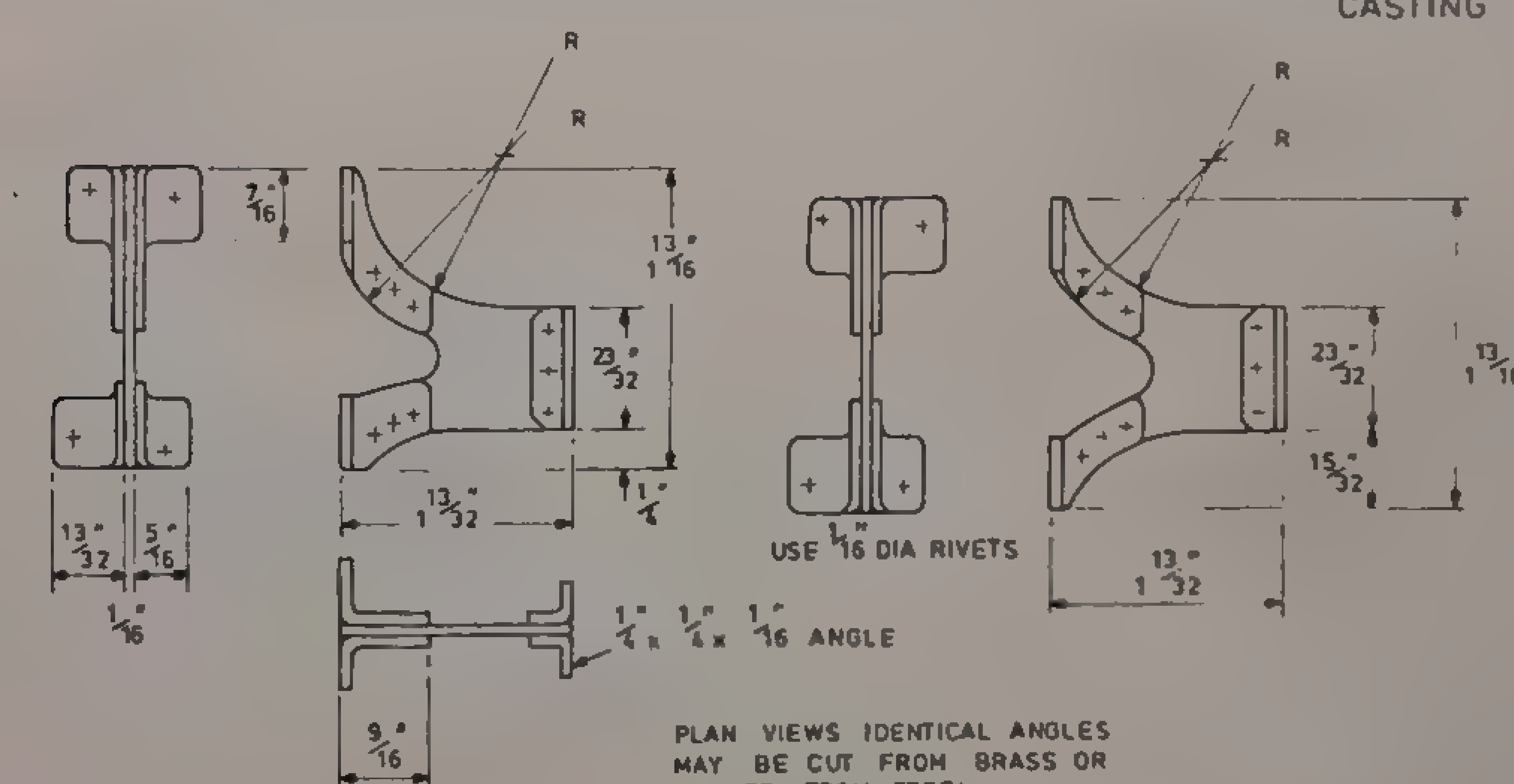


ITEM 33 REAR FRAMESTAY 1 OFF MILD STEEL

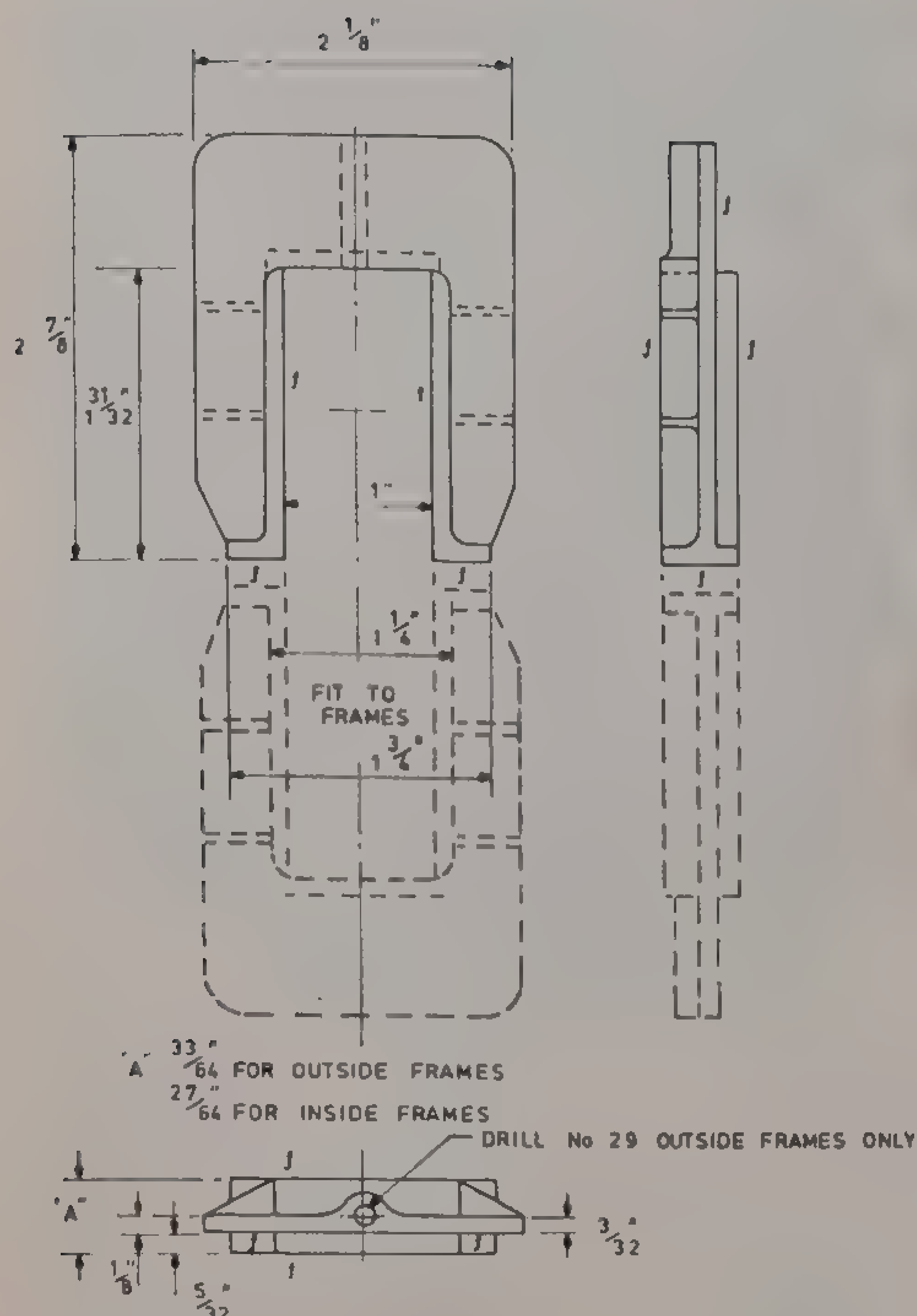


DIMENSION "A"
4 OFF "A" = 1/4"
4 OFF "A" = 19/64"
LOCATE HOLES FROM FRAMES

ITEM. 26 SPRING-PIN GUIDE BRACKET
CASTING



ITEMS. 12 - 14 CYLINDER FRAME BRACKETS
2 OFF EACH RIGHT & LEFT HANDED. MILD STEEL



HORNBLOCKS
NOT SCALE PATTERN
4 OFF OUTSIDE
2 OFF INSIDE } CASTINGS

are drawn wrongly, for they are shewn with sharp exterior angles at the bottom of each. In fact, this can be seen from the photograph, page 330, in the part on the general arrangement.

I find that the simplest way to make these steps is to cut some 20 s.w.g. mild steel blanks (the size for the largest steps would be 2 11/16 in. x 1 in.) and cut a square bit out of each of the two corners on a "long" side, then bend up with judicious use of light hammer with the piece held in vice-jaws as described in the last episode. A touch of sif-bronze or similar will then make it strong; trim off excess. Then place each step on a flat surface and scribe round the rough edges with a height gauge; trim off and file smooth. If you haven't got a height gauge, then use a piece of steel ¼ in. thick and allow a tiny bit more. I recall that many years ago someone suggested in *M.E.* that the knowledge of and possession of a height-gauge and surface plate was of more use than a lathe. I hope he had tongue in cheek; for I would like to see who first finished an engine — me using a lathe or him using a height-gauge. Still, they are very useful items to have around.


Cylinder frame bracket.

Last year, I picked up a 30 in. by 20 in. surface plate, secondhand but still in good condition and, cleaned up a bit, it has already just about paid its way. It is mounted as the top of a portable work-bench with a few shelves below; these are 30 in. x 20 in. plywood. The framework is 1 in. x 1 in. x ⅛ in. steel angle, with casters on the bottom. I have three of these type benches, one as described with the surface plate, one with only shelves (wooden top) and one a bit larger with steel top covered with asbestos sheets. A brazing bench of course; all brazing equipment such as solders and fluxes, torches, etc. live on the shelves below. The advantages of such portable benches are quite note-worthy; for example I recently dealt with some cast-iron cylinders weighing 23 lb. each. There were seven of them; each had to be machined up in steps on different machines, therefore they could all be stored in neat rows on the bench and wheeled from place to place which made my life a lot easier. The bench was parked close to the machine concerned, saving energy in lifting.

The steps, like the top angles, can be fixed permanently to the frames at this stage. I recommend de-greasing and use of a drop of Loctite to assist the rivets: it adds a good ration of firmness.

Item 26. Springpin guide bracket

Castings are available for these. Machine the sides nearest the frames, the remainder may be trimmed with a file. Incidentally, the castings for these engines are of extremely high quality; they are all "shell mouldings", I understand. They are cast as a stick of four which makes life easier when holding them down for machining. These, too, may be mounted on the frames; make sure that they are in line vertically by pushing a piece of ⅛ in. dia. steel through the holes before drilling for rivets.

Items 12-14. Cylinder Frame Brackets

I have had to distort these slightly as mentioned in Part 3, for the inside part of the bracket (the double part, shewn to the left of the drawing) is actually mounted by the cylinder bolts. Frankly, these items are very nasty to make, and I strongly recommend the use of castings, which only need cleaning up to the correct width.

If you feel that you simply must fabricate, then here is how. It took me several tries before I found out a good way. Begin by cutting out the main part of the bracket; you will need two-off of each type. The small brackets are no problem (these are drawn on the right) and may be made from angle or folded out of steel. The problem comes with the queerly-shaped angles at the forked ends. It is best to make some special angle up out of steel (folding) and they should have one web trimmed to 9/16 in. wide at this stage. (The other web will be dealt with later; have two pieces of angle about 2 in. long.) Use the bracket as a template to mark out the curved edge on the finished angles; don't forget to make them handed. Cut and trim these curves to shape, mark out rivet holes in one only, line them up on each side of the "body" of the bracket and clamp. Drill through, separate the parts, remove sharp edges. Assemble using a dollop of Loctite under each bit and rivet firmly (steel rivets). Then the remainder can be marked out and cut away, finishing with a file. I tried several methods of making these curved parts, and found it extremely difficult to get them to line-up if separate bits were used.

Further Thoughts of Builder Wilson

These frames are very thin, even with the stiffening plates in place. It occurs to me that there is just room for hornblocks of the more usual type should anyone wish to fit them, they could add quite a lot to the frames, in the way of rigidity; and could also be easier to fit. I have drawn up a suitable casting, shewn herewith.

These should be cast in pairs; follow the following instructions for machining to get good results. I have used this method of making horns many times now, for whereas it is no problem to mount even up to 3½ in. gauge frames "back-to-back" for machining, it is a bit harder with 5 in. and really out of the average range of milling machines with 7¼ inch. Admittedly, a 5 in. gauge G.W.R. "King" can be completely machined (oh yes it can — 'cos I've done it) on a Myford lathe; there are certainly easier ways of being masochistic. (I think that the biggest locos to have *all* the lathe work done on a Myford were my recent batch of three G.W.R. "Castles", plus a spare chassis for the "Great Bear"). The Myford was standard apart from the special mounting blocks that raise the lathe centres to 6 or 6½ in., I forget which.

Cut a piece of steel 3/16 in. thick, 1⅛ in. x 3¾ in.; drill two holes on centre-line at about 2¾ in. centres; size to suit any convenient holding-down bolts. With this, clamping the double casting down under a vertical mill (or onto a vertical slide of a lathe) is easy, the outside can then be machined to exact size to fit into frame slots. Remove from slide or mill, and do the others likewise. Mount again, this time by dogclamps round outside face, and machine inside to correct size for axleboxes. It is easy to line up so that these two machining operations are dead parallel, simply use a piece of steel as a gauge between part of the mill (or the lathe bed) and one of the already-machined sides; at this stage also clean up the face of the hornblock. Remove from machine, cut in halves (mark in pairs before this operation!) and machine off hornblock bottoms. Then mount in frames in the usual way. The correct "scale" horns will be dealt with next instalment.

As a matter of interest, these big horns were schemed out and drawn up on Christmas Day; being a person who cannot long remain idle and not wishing to see the "Ozzard of Whiz" too many more times, I sought solace in the refuge of all true model and miniature engineers — the workshop.

A brief note for the good folk who write to me *or* to any other person in the trade or business; for the love of Pete, *print* your name and address. It is always embarrassing to have to write to "Dear Mr. Squiggle", and does not help to encourage a brisk reply. We all do our best; the impossibles are done immediately but the miracles take a little preparation. Thank you in hopeful anticipation.

To be continued

JEYNES' CORNER

An engineer looks back

AS USUAL, I was very interested in George Thomas's article on making ball handles. I have never seen the balls turned and stuck on the shank, but of course there was no such thing as "Loctite" available in the days of my apprenticeship, nor yet when I returned from France to work in Coventry Ordnance Works Toolroom during World War I.

Many ball handles of all types were required for new machines, and also for the millwright's repair shop, and I certainly had my share of these. The type of ball handle described by Mr. Thomas was then known as "Angle Ball", usually used for tailstock or slide locking. The locomotive department required large handles without a ball on the outer end; the shank tapered outwards. The most usual job however was the balanced type, with three balls of different sizes.

These latter were produced by turning between the centres; being cut off longer than the finished size to allow elimination of centre-holes. The stock was turned to a taper which embraced the diameters of all three balls, centres of which were taken from either a broken pattern or a drawing. The tailstock which had been set over for this, was left while the balls were turned with the slide-rest tool by "Scowl of Brow", so that the shanks between the balls could be turned to the same taper, which made a nicely proportioned handle. The handles to be fitted into the small end balls were turned in pairs, as their mortality was high; the ends were turned for the thread, slightly undercut at end, and the angle turned to seat into the ball body, which gave a stronger job. They were then screwed and chased a thou or two over-size to allow a force fit in ball. The angle ball handles were also turned between the centres in pairs.

The handles were then chucked, the flat bearing surface turned and bored to requirements, some taper, and some parallel. The angle balls were generally drilled right through and tapped.

To finish off the balanced ball type they were turned over in the chuck and the locking face turned, then set up for the blind hole in the small ball, using the bearing flat as a register to keep square. They were drilled and tapped with blind hole taps, five to a set, and the angle seat turned to receive the handle.

A graver about ½ in. wide was used as a help in forming the balls supported by the chasing rest, and some file was often applied too, but there was a war on, and Exhibition finish was "out".

I recently mentioned Cross Drilling of round stock, but at the time was unable to find a photograph of the "Wildy" drilling jig made for this purpose. It had a Morse taper shank, so that it could be used in a lathe tailstock, and the base, which could be clamped to a drilling machine table, had an accurate taper socket to receive the taper shank; it could also be used for hand drilling.

From Model Engineer, 13 Jan. 1921.

It was fitted with an adjustable gauge which was graduated to determine the distance of cross-drilled hole from end of stock. It was made in three sizes: No. 1, 3/16 in. to ½ in.; No. 2, ¼ in. to ¾ in.; No. 3, ⅜ in. to 1¼ inch. Each size was provided with three hardened drilling bushes for 3/32 in., ⅛ in. and 5/32 in. drills.

It could accurately enable drilling of square and hexagonal stock, not only through the flats, but corner to corner as well. As the drill guide was screwed down by knurled grip on to the stock itself, it was impossible for the drill point to wander.

Another useful device which one does not see so much of these days, was the Brown and Sharpe sets of taper gauges. These were in sets of ten, that is five pairs; the outside edges were radius ground, and the diagonal edges ground flat, so that by sliding one upon the other, a continuous increase or decrease of parallel measurement could be taken by micrometer or vernier across the outside edges.

They were most useful in measuring bearings in position, for wear, and out of round, and could also be applied to measure square, hexagonal, or oval holes. The set I once owned when engaged on plant maintenance far away from plug gauges, consisted of five pairs in a nice little wooden case which travelled constantly with me. To use, a smear of clean, thick oil was rubbed on the flat faces, which stopped them from falling apart when entering the hole; they were slid together until tight in the hole, then the mike was applied to the radiused outside edges. The smallest hole that could be measured by this set was 3/16 in., and the largest 1¼ in. To use on larger holes, a piece of hardened and ground steel ⅝ in. x ¾ in. was interposed between the largest pair, which covered most of the plain bearings on the lighting plants.

3 in. FREELANCE FODEN TYPE STEAM WAGON

by Alan Pickering

(Bournemouth Model Engineers)

HAVING RECENTLY COMPLETED a four-cylinder 3½ in. "King", a 3½ in. "Mountaineer" and several stationary engines, I fancied a complete change from the constraints and problems of true scale models and wanted to be set free to make something useful that didn't have the built-in problems that expensive locomotives have. Mainly something that:

1. Doesn't need rails and can run anywhere.
2. Has 100 per cent accessibility for driving, firing and all controls.
3. Doesn't need a driving trolley.
4. Doesn't require complex wheels.
5. Is cheap and fun to build.
6. Has no expensive castings (cylinder only).
7. Is big and rugged enough to be undamageable.
8. Can be taken round to the steam rallies and Pete's.
9. Can be left in steam unattended.
10. Nobody can pick holes in it (as it's the only one).

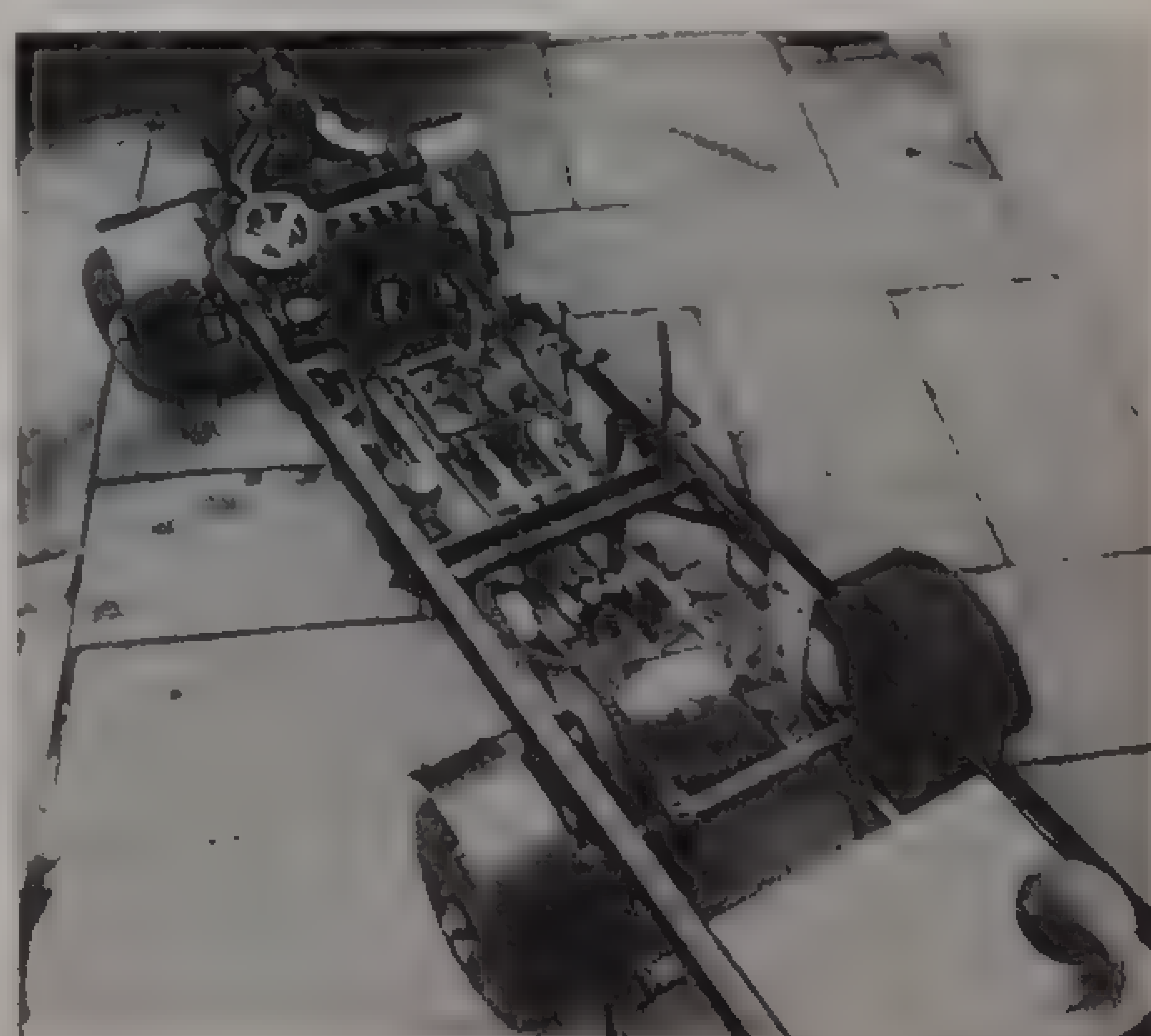
Having seen a chap enjoying himself on a model "Sentinel" steam wagon at a steam festival I decided, after questioning him, to have a go at my own thing and try to avoid his pitfalls.

The 6 in. dia., ¼ in. steel (tube) boiler is to Mr. Morris's published design for the 3 in. scale Foden, as is the basic chassis frame. ½-inch copper firetubes are used, no superheaters, tubes are expanded and Loctited into ¼ in. tubeplates. This method proved difficult to seal the tubes but once sealed using traditional starch has proved 100 per cent, steel boilers seal themselves.

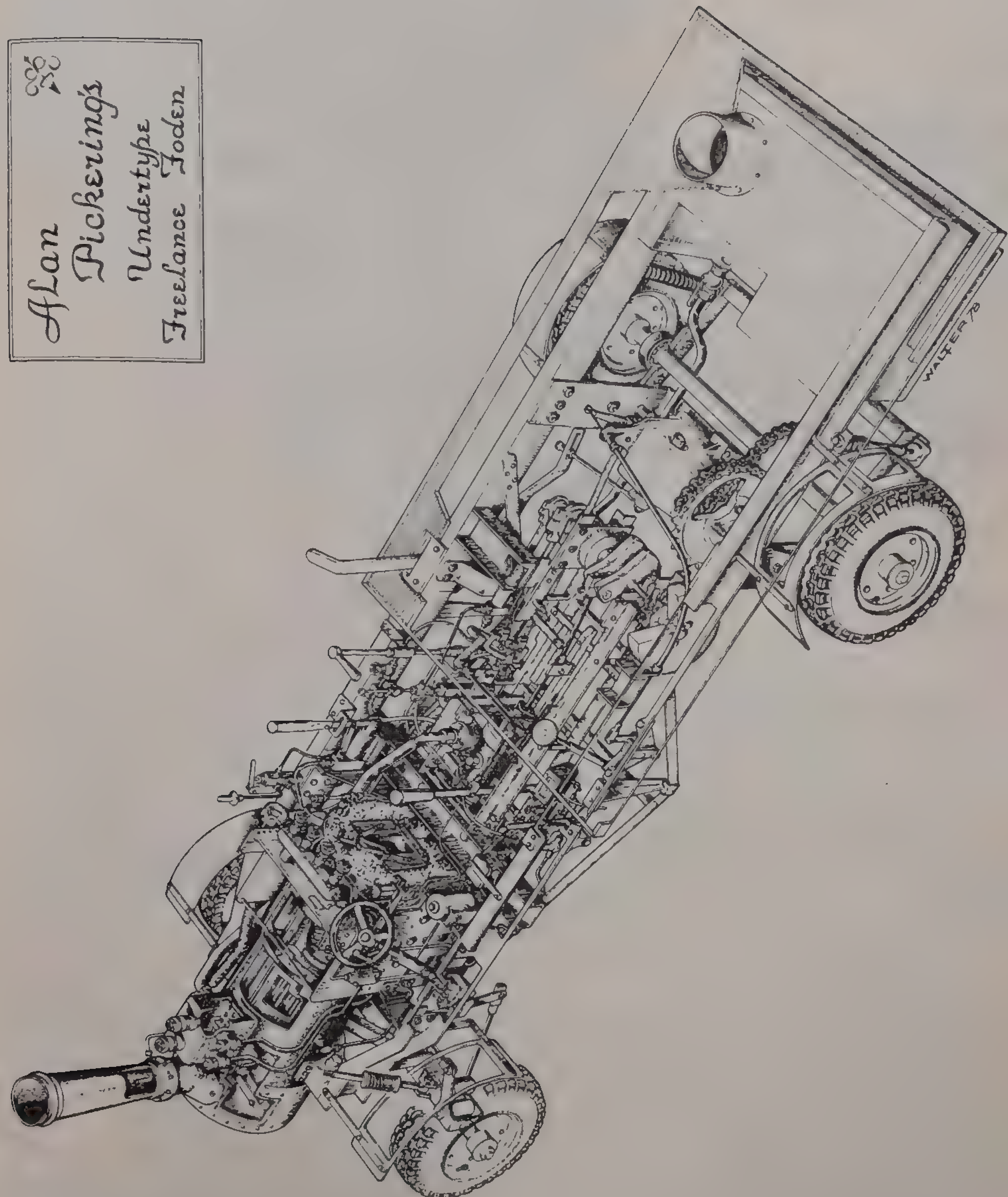
The dome was my idea — a slice of oblong ¼ in. thick tube.

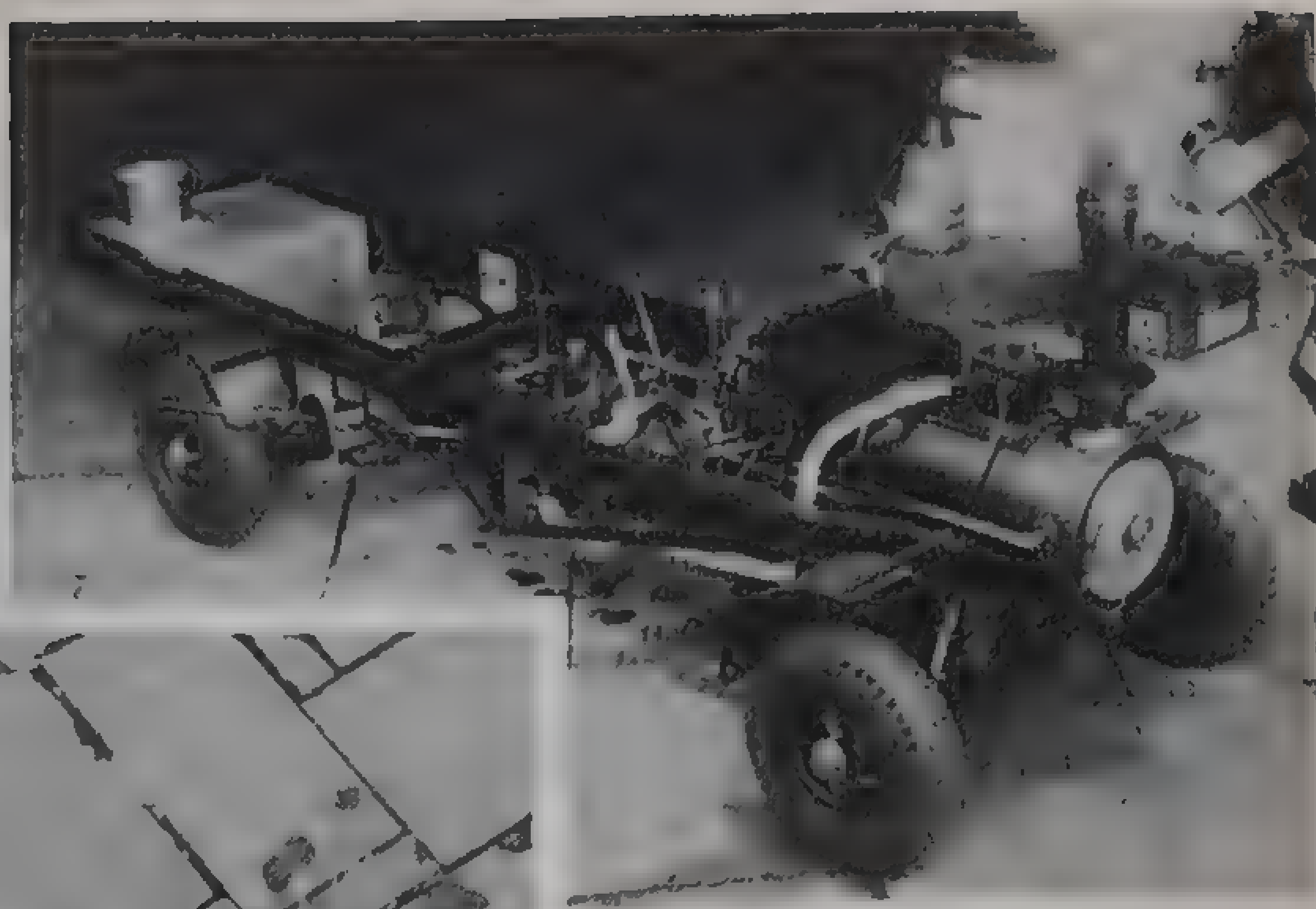
The engine is freelance using Stevenson's gear with launch type links; it was made undertype for the following reasons:

1. A big powerful engine could be slung between the frames (2 in. bore by 3 in. stroke), also good weight distribution.



Alan Pickering's Undertype Freelance Foden





2. Transmission problems to rear wheels are eliminated needing only very short chains.
3. A big single could be used, thus ensuring that the magic sound of a steam engine under load would not be lost, as in the case of twins and compounds. (Expensive and complex castings are required for a compound or twin overtype engine and it must be limited to the physical size of the available space, all geartrains and dog clutches are required.)

The only negative point is that the undertype makes for a wet steamer, but it is O.K. if left ticking over, which is what spectators want anyway, and it adds realism.

Various features of the wagon are:

1. Twin vertical injectors.
2. Mechanical feed pump and bypass valve.
3. Emergency hand pump.
4. Stuart steam donkey pump.
5. Positive locking instant reverse lever (strong horizontal spring rocking either side of horizontal centre pivot).
6. Hydrostatic lubrication and sight feed and mechanical lubrication on feed pump.
7. Large four-note chiming whistle (not shown).
8. Albion 3-speed (lawnmower) gearbox.
9. Only one rear wheel driven.

The project has taken about one year and has proved a wonderful plaything, always attracting attention.

A photograph appeared in *Model Engineer* No. 3578 (3-16 February). Budding builders will need four warehouse trolley wheels 10 in. dia. for this design, an arc welder, very little money and access to the scrap pile of the local wrought iron gate maker. Nothing (apart from the boiler) has been put down on paper and no sketches made of any part. It was a case of "if it looks right, it is right".

Basic calculations of the boiler's capacity to steam a 2 in. by 3 in. cylinder at 1000 r.p.m. at 60 p.s.i. proved correct and the boiler never runs out of steam. It will pull up the steepest gradients on the local playing fields (King's Park 3½-5 in. gauge railway, Bournemouth) and bellows and snorts like the real thing. Our local artist saw it at an exhibition and sketched it.

Anybody wanting a print 15 in. by 12 in. or with the hidden detail externally drawn should contact Clive Walter (Technical Artist), 5 High Mead, Longham, Dorset. Tel: Northbourne 3547. Price 50p.

Dimensions

Overall length, 5 ft. 10 in.
Overall width, 2 ft. 0 in.
Wheelbase, 3 ft. 8 in.
Weight, 2 cwt.

Constructional details and drawings for a Clayton Undertype Wagon to 2 in. scale, designed by Robin Dyer, will commence in July.

A HIGH PERFORMANCE WATER PUMP

by A. Beavan

IN PRESENTING this article I think that I should explain my reason for fitting an axle-driven water pump to my 3½ in. gauge 2-6-4 tank locomotive which is based on the Stanier L.M.S. one. On my other locomotives fitted with tenders, injectors had supplied all the boilers' needs, but having no experience of the performance of these injectors when supplied with warm feed water from the side tanks, a decision was made to play safe by fitting a pump together with one injector. This would enable me to run the engine and at my leisure to play with the injector and if necessary to try the effect of different combinations of cones.

As no such pump is fitted to the full-scale engine, I had a good excuse to design and develop one based on sound engineering practice and embodying such features that I considered desirable in a small-scale unit.

The outcome of these deliberations and subsequent work is shown by the accompanying sectional drawing of the pump body together with the various photos. Its principal features are: two single-acting pistons; an air chamber, wing-type valves, detachable valve seatings and adjustable lift stops for these valves. The pistons are sealed by "O" rings and slide-in trunk guides.

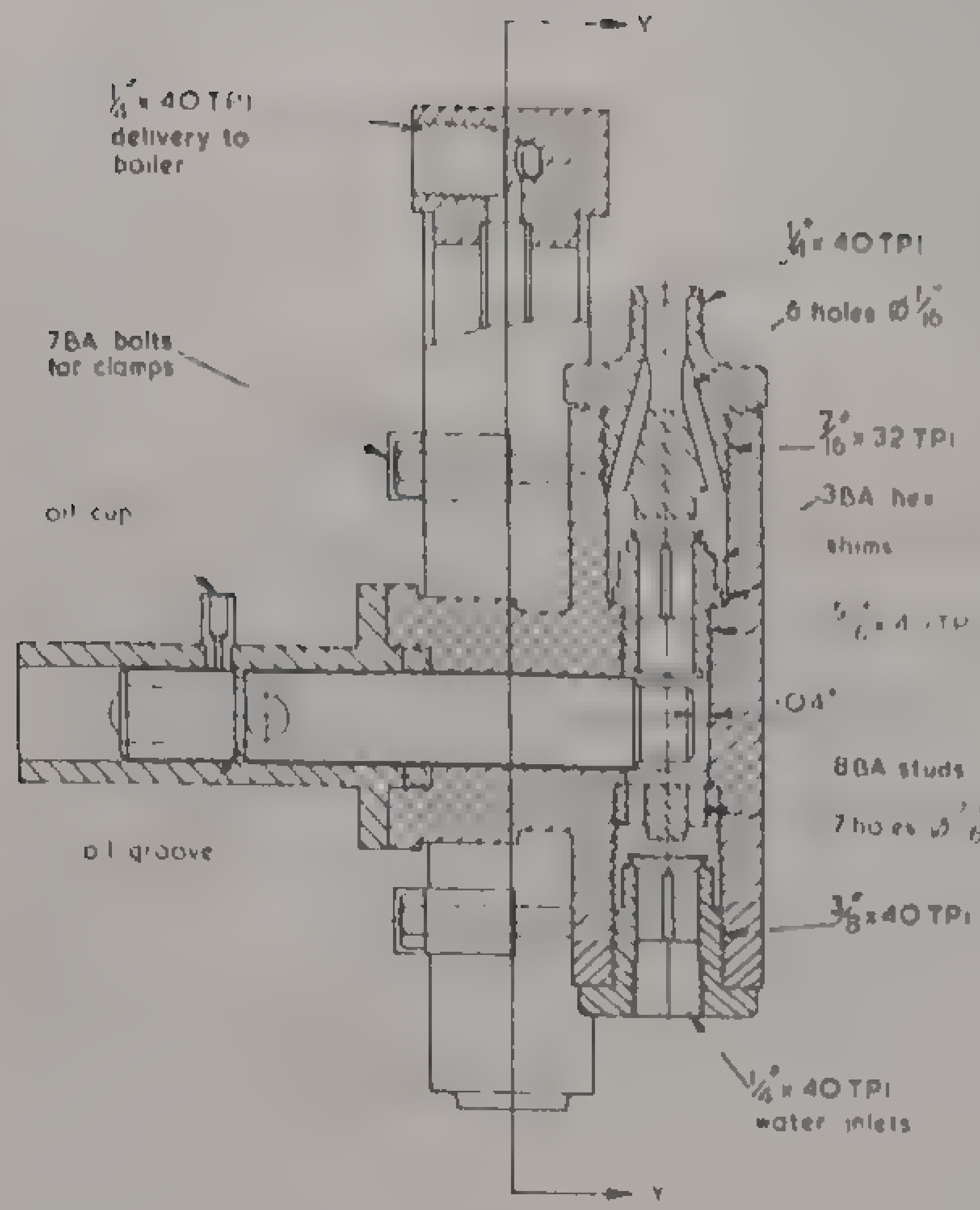
As I hoped to get a high volumetric efficiency, the clearance volume was kept to a minimum, and all the internal passage areas were made greater than the area of the associated pipes. The main dimensions are: piston, 5/16 in. dia. and 7/16 in. stroke; inlet valves, 7/32 in. dia. with .04 in. lift; delivery valves 3/16 in. dia. and .03 in. lift.

The air chamber has a volume equal to twelve times the capacity of one piston stroke. Pipe sizes are: inlet 3/16 in. O.D. x 26 s.w.g. and delivery is 5/32 in. O.D. x 26 s.w.g.

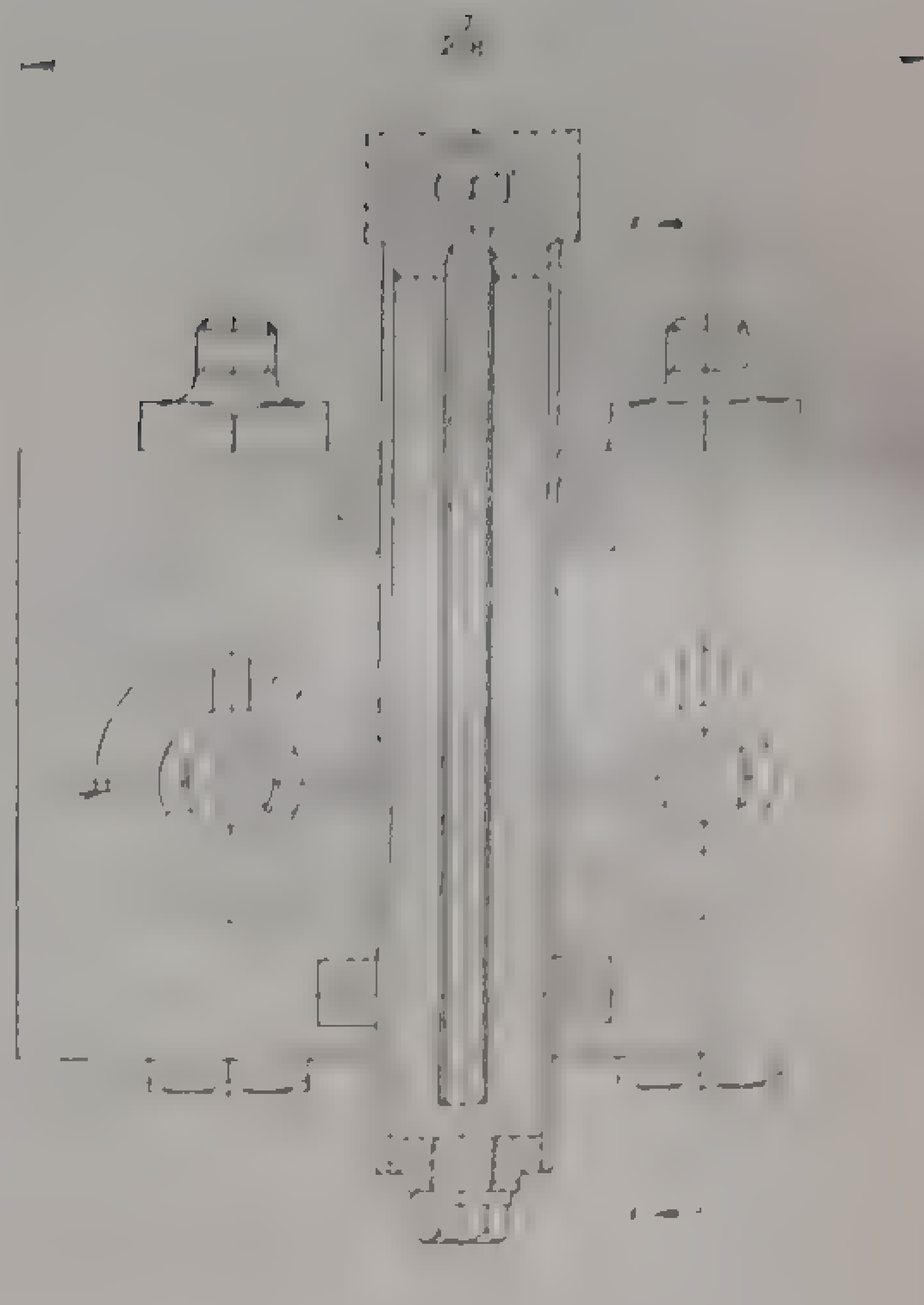
In the following brief description I have not attempted to give details of the methods used for making all of the items involved, as a study of the drawing will show that most of them are simple turning and drilling jobs and need no detailed explanation.

One other item I should mention, as these pumps are tailored to fit each type of engine and also to suit each maker's personal ideas, I have only given the main dimensions of my pump, which can be used as a starting point for anyone designing their own pump. Other dimensions can be scaled from the drawing. However, just a few of the fittings did involve a little more thought than usual, so the methods adopted will now be described as they may also be of general interest.

Starting with the pump body. This is a gun-metal casting and the first operation was to machine flat its rear face. This was used as a datum face for



Section X–X



Section Y–Y of air chamber only

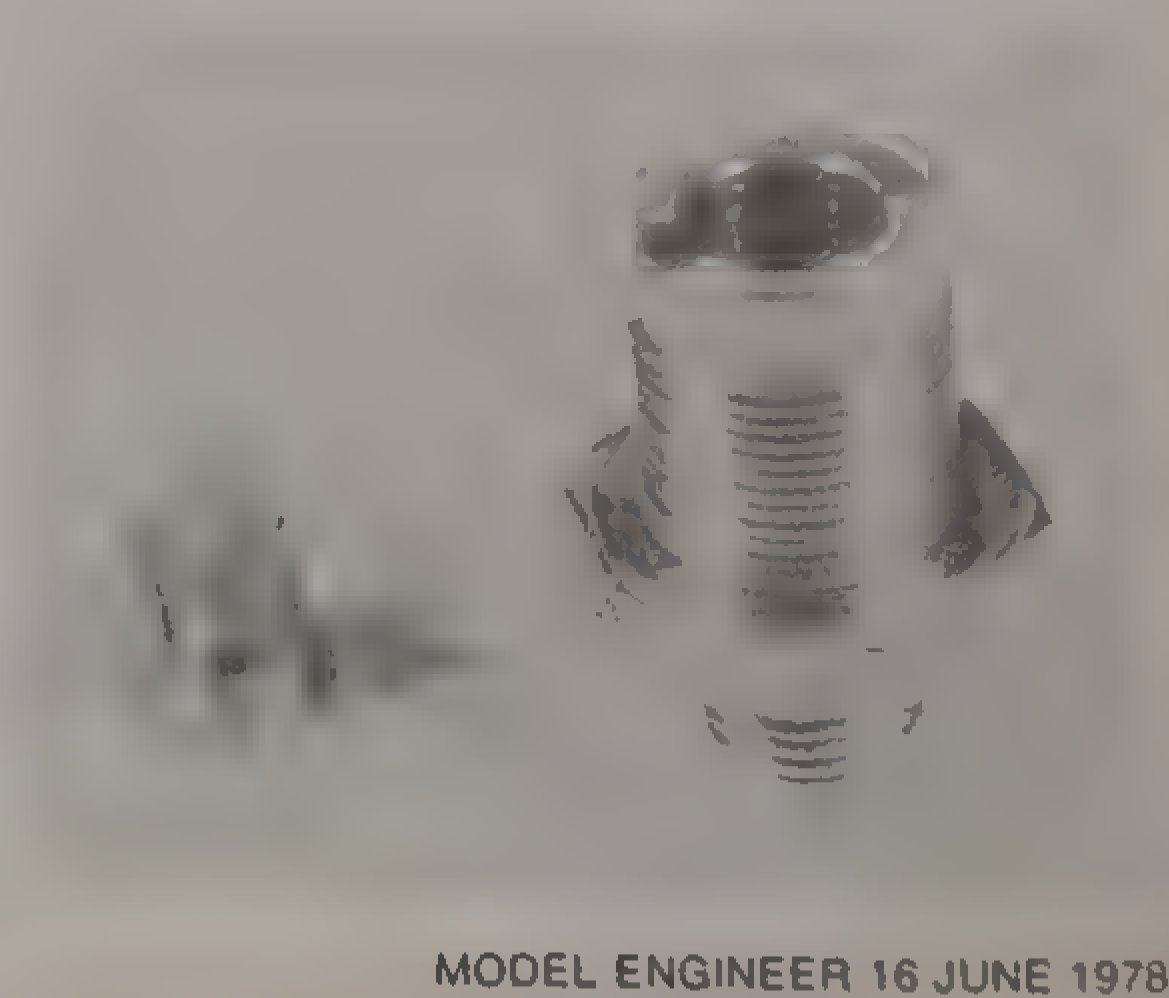
subsequent machining operations. An angle plate was next bolted to the lathe face plate, then the pump body secured to it in such a position to enable the two sides, which fit between the main frames, to be machined. The body was then rotated through 90° on this angle plate and slid sideways so that the threaded holes for the valve seatings could be machined. To machine the cylinder bores, also the "O" ring recesses, the body was bolted directly to the face plate on its rear datum face.

The next job was to make the valve seats from nickel bronze drawn bar. This material was chosen in the hope that it would suit the drawn phosphor bronze used for the wing valves. The inlet valve together with its seating is shown in the photo. Starting with this inlet valve seat, the bar was first threaded ⅜ in. dia. x 40 t.p.i. followed by boring the 7/32 in. dia. hole for the valve. The seat for the valve was chamfered at 45° to the bar axis, with a width of .03 in. It was next parted-off to final length. It was then held in a threaded adapter, the end tapped ¼ in. dia. x 40 t.p.i. and the hexagon formed.

The delivery valve seat machining had to have a different sequence. For this, the first operation was to cut the 5/16 in. x 40 t.p.i. on the bar, a piece slightly longer than the finished job was parted-off. Next it was held in a threaded adapter and the hexagon formed. Still holding it in this adapter, the 3/16 in. dia. hole was bored and chamfered as per the inlet valve seat.

The machining of the wing-type valves from drawn phosphor bronze bar proved to be more simple than envisaged. Three holes which would form

Wing valve details.



the flutes were drilled axially in the rod to a depth equal to the final wing length. The drawing shows the method of manufacture. These holes were No. 26 drill for the inlet valve and ⅛ in. dia. for the delivery valve. The outside diameter of the wings was turned to be a free fit but without shake in the seatings.

The chamfer at 45° to the bar axis was added together with a clearance groove and the valve parted-off.

As a result of many tests up to 250 p.s.i. I have found that it is not necessary to grind in these valves, provided that the contact faces are true and have a fine machine finish.

The remainder of the fittings were made from brass or gun-metal bar. The air chamber used a piece of seamless brass tube, the end fittings being secured by silver solder. As this air chamber is subjected to a pulsating pressure, it was tested hydraulically to 250 p.s.i.

The eccentric rods, shown in the photo, are forked and attached to a standard type of gun-metal strap.

Lubrication is effected by a drip feed into a tray attached to the strap. Inside this tray is a baffle plate which holds down a lubrication wick and also prevents oil splashing out.

On final assembly the inlet valve lift stop was secured by the use of "Loctite" (screw lock grade) after the correct lift had been obtained. Shims were fitted under the delivery valve seat to achieve the same object.

I now wanted to test this pump. Various rigs were considered but in the end I assembled the pump together with the pair of driving wheels, which carried the pump eccentrics, to the bare chassis.

To drive the wheels, a wooden roller mounted on a dead axle and supported on the bench top was driven by an electric motor. The chassis was then positioned and suitably restrained from moving, so that the engine driving wheels rested on this wooden roller. The weight of the chassis was sufficient to enable the roller to drive the wheels and thereby operate the pump.

The final big question, would the pump work, and if so, would its performance come up to my expectations? I therefore had to measure the delivered volume of water at boiler pressure per minute and at a known r.p.m. of the driving wheels. This could then be compared with the theoretical displacement to obtain the volumetric efficiency. In addition I wanted to get an idea of the surge pressures in both the delivery and the feed pipes.

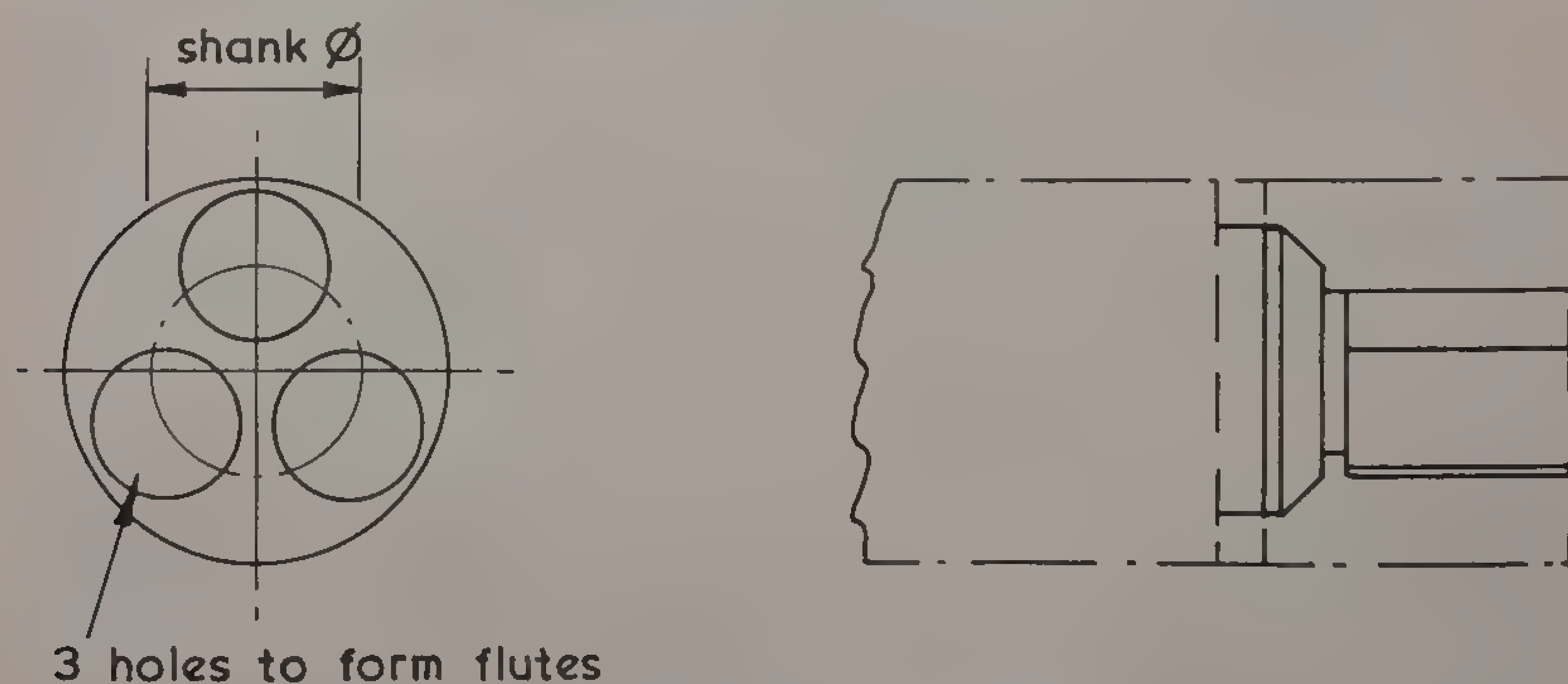
To get this data, pipes and gauges were arranged in the following manner. The feed pipe was taken to the pump from a water tank on the bench top, a vacuum gauge adjacent to the pump being joined to this pipe. One end of the delivery pipe was attached to the air chamber union, the far end being fitted with an adjustable safety valve which discharged the water into a calibrated container.

A pressure gauge together with a hand pump was joined into this pipe close to the air chamber.

The water tank was filled and then with all fingers crossed, the motor switched on. The pump worked!

It was allowed to run for about ¼ hr. to let it settle down whilst I attended to the lubrication and then it was stopped. At this stage I enlisted the aid of a friend to help with the various observations.

The safety valve was set to open at 80 p.s.i. and the delivery pipe pressure held to this by the use of the hand pump. The pump was again switched on.



WING VALVE—MACHINING METHOD

Eccentric rods.

Water flowed at once. After a short time the following readings and observations were recorded.

The actual measured volume of water delivered per minute against a boiler pressure of 80 p.s.i. was 312.54 cubic centimetres. The axle speed was 300 r.p.m. If this is compared with the theoretical displacement of 329.93 cc. it will be seen that a volumetric efficiency of 94.7% has been achieved.

The other observations were interesting, for although the water delivery was quite steady, yet the pressure gauge hand vibrated over a range of 14 p.s.i., whilst the vacuum gauge registered only 1 in. of mercury. No vibration could be detected in the pipes.

It should be noted that although great care was taken in observing these results, due allowance must be made for experimental errors.

So now all I have to do is to complete the engine and test it on the track.

Finally, I wish to thank my friend Mr. George Thomas for supplying the excellent photos of this pump and also for his unfailing help and advice on this project and on many other matters.

CLUB DIARY

Dates should be sent at least five weeks before the event to ensure publication. Please state venue and time. While every care is taken, we cannot accept responsibility for errors.

JUNE

16 **Furness Model Railway Club.** Advance formal notice of A.G.M. at the Foresters Hall, Duke Street, Barrow 7 15 p m

17 **Romney Marsh M.E.S.** Portable track at Lydd Club Day, 12 noon onwards

17 **St. Albans & District M.E.S.** Redbourn School, Redbourn. Loco meeting

17 **Southampton & District S.M.E.** Chairman's evening.

17 **S.M.E.E.** Films by British Aluminium Co. Ltd.

17 **Milton Keynes Model Society.** M.S. portable track, Castlethorpe Village Fete, Castlethorpe, Milton Keynes. 2 p m

17 **National Childrens Home** open day and fete. To be held at Princess Alice Drive, Chester Road North, Sutton Coldfield, W. Midlands. Admission by programme 10p

17 **Ickenham & District S.M.E.** Open day and exhibition Rear of Coach & Horses, Ickenham, Middx 2 to 6 p m

17/18 **Gauge 1 Model Railway Assocn.** Plumstead gala and model railway exhibition — portable track Plumstead Manor School, London SE18

17/18 **Erith M.R. Soc.** Plumstead Erith M R S exhibition, Plumstead Manor School. 10 30 a.m. to 9 p m. Sat. 10 a.m. to 6 p m. Sunday.

18 **Portsmouth M.E.S.** Visit to Bristol S M E with locos

18 **Whitchurch (Cardiff) & District M.E.S** Club visit to the Harlington Loco Society

18 **Milton Keynes Model Society.** M.S. Portable track. Thornton College, Buckingham. 2 p m

18 **Harrow & Wembley S.M.E.** Public running Roxbourne Park track. 2 p.m

18 **King's Lynn & District S.M.E.** Public running. Walk Track, London Road, King's Lynn. 2 to 5 p m

18 **Ardeer Recreation Club.** M E section. S.W. Scotland Meeting 12 to 6 p m

18 **Harlington Locomotive Society.** High Street, Harlington. Visitors day 10 a.m. to 6 p m. Open invitation to other clubs to run at Harlington. Please let Social Sec. know if you intend to visit

18 **Worcester & District S.M.E.** Public running day. Waverley Street, Dighs, Worcester 2 30 p m.

18 **Guildford M.E.S.** Public open afternoon.

19 **Wigan & District M.E.S.** Meeting

19 **Leicester S.M.E.** Radio control cars. The Royce Institute, Crane Street, Leicester. 7 30 p m

19 **Worthing & District S.M.E.** Informal evening. Broadwater Parish Room. 7 30 p.m.

20 **Chesterfield & District M.E.S.** General meeting. Bryan Dona[illegible]

21 **Cannock Chase M.E.S.** Meeting Lea Hall club. "Bagnall Price valve gear". Don Dutton. Meeting at Lea Hall club. 7 30 p.m.

22 **Leyland, Preston & District S.M.E.** Meeting at Roebuck Hotel, Leyland at 8 p m

23 **Rochdale Soc. M.E.E.** Springfield Park Models running night

23 **City of Leeds S.M.E.E.** Erecting portable track at Crompton Parkinsons, Guiseley. 7 p.m.

24 **Romney Marsh M.E.S.** Portable track at Ethinghill hospital fete. 2 p.m.

24 **E. Sussex Model Engineers.** Portable track at Lions Fete, Polegrove, Bexhill on Sea

24 **King's Lynn & District S.M.E.** Gaywood Church fete — portable track in operation

24 **Bracknell Railway Society.** Bracknell track open day

24 **St. Albans & District M.E.S.** St. Dominic's School, Harpenden. Loco meeting

24 **City of Leeds S.M.E.E.** Operating portable track at Crompton Parkinsons, Guiseley, for kids sports day. From 1 p.m.

24 **Cambridge & District M.E.S.** Track days. Open to public 3 p.m. Fulbrooke Road, Cambridge.

Continued on page 722

Club Chat . . . with the Editor

There has been one or two items recently about the closure or lack of support for clubs so it is really refreshing to be able to report the formation of a new society. A few weeks ago the JCB club was formed, now there is another, the **S.T.C. (Paignton) Model and Engineering Society** which has been started by the staff of Standard Telephones and Cables Ltd. (Paignton). The secretary is Mr. H. Couldwell of Bank Cottage, Bank Lane, Totnes, Devon TQ9 5EH, who tells us that the new club meets monthly on the second Monday and Thursday alternately. Those members of the late Torbay M.E.S. who are still keen have joined this society so that the membership stands at about 70. Like JCB, the company has offered space and social facilities which is all to the good of the club. July's meeting is on the 13th and from there on the dates are 14th, 14th, 9th, 9th and 4th up to the end of the year. The address is S.T.C. (Paignton) Athletic & Social Club, Brixham Road, Paignton, and meetings start at 7.30 p.m. On 5 August the club is holding an exhibition in the main hall of the club.

At **Malden & District S.M.E. Ltd.** they have had the same sort of wet Spring that many other clubs experienced so that their May Day running was rained off. However, it hasn't all been bad and several new locos have made an appearance this year including Jim Haycock's 7¼ in. "Tinkerbell" and George Smith's 7¾ in. "Pegasus". These are, of course, both narrow gauge, but on the raised track two 5 in. locos made their debut — Mr. Sainty's "Uniseke" and Norman Lockwood's "New Yorker". There have been a couple of talks in the clubhouse, one by Mr. John Sharpe of local government on "Safety in the Workshop", and the other by Mr. Roy Fisher of John Piper Accessories on "Centrifugal Castings". Laurie Martin has resigned his post of Social Secretary and Mr. J. E. Cook, the Hon. Sec., has asked us to express the club's gratitude for his efforts and at the same time welcome Janet and John Motram who have taken over the duties.

At **Milton Keynes M.S.** they have extended their portable track to 140 ft. and thanks are due here to Ray Bellchambers for the use of his workshop and Mrs. Bellchambers for providing suitable refreshment. The track was chosen for Mickey Mouse's Birthday Party at Alexandra Palace on 28/29 May.

At Cultra, the **Model Engineers Society N.I.** had good weather for their Easter Monday Open Day and the Transport Museum saw good crowds which then spilled over to the club's track. Stan Sutton had his 7¼ in. gauge "Hercules" running and did good service for five hours hauling the visitors around; a free ticket system allowed a check to be made on the number of passengers carried and the final figure reached 630. In addition Martin Agnew's 3 in. Burrell T.E. operated inside the track and 3½/5 in. locos included "Mountaineer", "Stirling Single", L.M.S. tank, two "Simplexes", freelance "Atlantic", and a "Virginia".

At **North London S.M.E.** Tony Higgins' article on tether racing cars has, as we hoped, caused some discussion as to whether the existing track was worth refurbishing and, if so, would sufficient people use it? Well, I hope the answer to both these questions is yes. There has been considerable reaction to the article and it appears that many of you still have your cars tucked away just awaiting the starting flag.

Huddersfield S.M.E. wishes it to be known that they have open Sundays and that visitors are welcome with or without locos. For the boat enthusiasts there is free running on the boating pond. Refreshments are available and the dates for these meetings are given in the diary columns.

In the 19 May issue I mentioned the committee changes at **Coleraine and District S.M.E.** but omitted to give the address of the secretary, Mr. Jack McCaughran. This is 7 Letterloan Road, Macosquin, Co. Londonderry.

King's Lynn & District S.M.E. re-elected all their committee at the AGM and this event saw the presentation of a pewter tankard to Robin Guilding who won the Loco Efficiency Trials in the Walks last October. The club hopes to hold another trials which are scheduled for Sunday, 10 September.

Nottingham Society of Model & Experimental Engineers Ltd. held their AGM on 16 March and of course, there were a few changes. The new Hon. Sec. here is A. P. Knowles, 12 Highfield Close, Ravenshead, Notts. The telephone number is Blidworth 5242. Next year this Society will be celebrating its Golden Jubilee and to mark the occasion there will be a 25th Exhibition. This will be held at the Victoria Leisure Centre, Nottingham, from 17 to 21 April and Professor Chaddock has again agreed to act as Chairman of the Exhibition Committee. Like all exhibitions, models are required and Mr. Knowles would like anyone wishing to enter a model to contact him. Meanwhile, our congratulations go to the club.

At Illshaw Heath, where **Birmingham S.M.E. Ltd.** held its Efficiency Trials on 2 April, the event was won for the second year running by Peter Wardle on his "Gresley". His final efficiency figure was one per cent which was a bit lower than last year. Vince Gotrel was placed second on his L.M.S. "Compound" 3½ in. and Ted Tucker third with his L.M.S. "Pacific", also a 3½ in. Unfortunately these three were the only entrants and next year there will have to be at least five to make the competition worthwhile, but the club hopes to introduce a trophy for the most efficient 3½ in. gauge loco which should encourage more entrants.

At **Norwich** the public running has started and, of course, people are required to assist with the operation. Hopefully, the dates for further running will be on the first and third Sundays during the summer months which means from 18 June, 2 and 16 July, 6 and 20 August, and 3 and 17 September. As I mentioned earlier, the Exhibition by this club in April was a resounding success and very indicative of the healthy state of the clubs up that way. Just over 5000 people visited the Exhibition and through sales of refreshments, etc. the sum of £75.60 was sent to the Norfolk and Norwich Branch of the Leukaemia Research Fund. And I think that it deserves a "very well done".

I see that locally there is a "Steam Engine Rally and Fayre" at Six Tunnels Farm, Gaddesden Row, near **Hemel Hempstead** scheduled for 9/10 September. On display will be all the usual interests — model engineering, miniature railway, vintage cars, tractors — I think just about every family event too. The gates open at 10.30 a.m. and the admission charges are 70p adults, 30p children and OAPs. Further details for trade stands, entry forms, etc. can be obtained from William "Jack" Evans, 222 Lawn Lane, Hemel Hempstead (Tel. 51361).

Here's another new club, this time in Canada, where **The Ottawa Valley Live Steamers and Model Engineers** has been formed following a meeting last September of all interested parties. The President is Phil Jaques, Vice-President Frank McLean, Secretary-Treasurer Ian Ross, and Executive Member-at-large Barry Kinsella. The immediate problem, of course, is to find some ground to lay a track. At present the monthly meetings are held in a different member's house and comprises a talk by other members on their various expertises. The secretary's address is 612 Chadburn Avenue, Ottawa, Ont. KIG 0Y7. Telephone number is (613) 521-3433. I hope we hear a lot more of this club — keep us posted, lads.

In the same country there is a raised track which has just been completed. This is 852 ft. long and the total amount of bits and pieces which went to its construction may deter anyone contemplating their own so I won't repeat all the facts and figures. But costwise — that's including wooden ties for the wall — it came out at about £3000, obtaining used ties. There are 1433 bolts and 6600 nuts. Good luck to Ottawa when they start. This track is at our old friends, the **British Columbia S.M.E.**, whose Golden Anniversary has been mentioned earlier.

Finally, back in the U.K., we are pleased to announce that the list for **IMLEC** is now complete. I am sorry that one or two clubs have been turned down because the necessary 15 arrived before their applications but perhaps they will have better luck next year.

Here's another shot of Basil Ryder on his KUR 2-8-4 (see Club Chat, 3 March).

CLUB DIARY *continued from page 720*

24 Stafford & District M.E.S. Barbeque County showground Stafford 7.30 p.m.
24/25 Chesterfield & District M.E.S. Open weekend to owners of 3½" gauge and 5" gauge locos. Track at Frank Merrifield School, Hady, Derbyshire
24/25 Furness Model Railway Club. Morecambe Bay Traction Engine club, steam engine rally. 11 a.m. at Waterside Farm, Stodday, Lancaster
24/25 Whitchurch (Cardiff) & District M.E.S. Portable track running at the Welsh Industrial and Maritime Museum, Bute Street, Cardiff Docks
24/25 N.W. Leics. M.E.S. Open weekend visitors with locos welcome or just come and look around. N.W. Leics. Miners Welfare Centre, Coalville, 9.30 a.m. each day with night running under floodlights
25 S.M.E.E. Public running for Ashton Court track. 11 to 6 p.m.
25 Harrow & Wembley S.M.E. Open day Roxbourne Park track. 11 to 5 p.m.
25 Malden & District S.M.E. Visit from Kingston Mentally Handicapped Soc. and a party from St. Ebbas Hospital, Epsom to the Society.
25 Sutton Coldfield & N. Birmingham M.E.S. Non steam day.
25 Harlington Locomotive Society, High Street, Harlington. Open day. 2 to 6 p.m
26 Willesden & W. London S.M.E. Sound film show
27 Romney Marsh M.E.S. Track meeting at Rolfe Lane, New Romney. 6 p.m
27 Milton Keynes Model Socelty. M.S. evening loco run. Cosgrove Hall track, Cosgrove, Milton Keynes. 7 p.m
27 Sutton Coldfield & N. Birmingham M.E.S. Live steam night. Wylde Green Library. 8 p.m.
28 Harrow & Wembley S.M.E. Track meeting Roxbourne Park track. 7 p.m.
28 Bristol S.M.E.E. Club meeting at the British Rail Staff Assocn. club. The Incline Temple Meads station. 7.30 p.m.
28 Guildford M.E.S. Special Gen. meeting for IMLEC and the M.E. exhibition. 7.45 p.m. at H.Q. Stoke Park.
29 Perranporth & District M.E.S. Talk — "An insight into Aeroplanes", at Perranzabuloe Church Hall. 7.30 p.m
29 Hull S.M.E. 10 minute night
29/30 (Schools) Crofton Beam Engines. Nr. Gt. Bedwyn, Wilts. Enq. The Crofton Society, 273 E. Grafton, Burbage, Wilts.
30 Hereford Live Steamers & M.E.S. 8 p.m. at Bulmers

JULY

1 Romney Marsh M.E.S. Portable track at New Romney Primary School Fete. 2 p.m
1 British Aerospace exhibition and running at Brough track.
1 Gauge 1 Model Railway Assocn. Get together
1 Milton Keynes M.S. Portable track, Bradwell, Milton Keynes. 2 p.m
1 Ickenham & District S.M.E. Public track running at rear of Coach & Horses, Ickenham. 2 to 6 p.m
1 Cannock Chase M.E.S. Lea Hall Children's Gala 1 p.m
1 S.M.E.E. Headquarters clean up
1/2 Crofton Beam Engines, Nr. Gt. Bedwyn, Wilts. Enq. The Crofton Society, 273 E. Grafton, Burbage, Wilts
1-4 British Columbia S.M.E. Golden Anniversary track meet. Official opening of B.C.R. station and raised track on Sunday 2 July
2 The Third Miniature Steam Rally to be held at Belvoir Castle, near Grantham, Lincs.
2 Harrow & Wembley S.M.E. Pondside. W. Harrow recreation ground. 10.30 a.m. and public running Roxbourne Park track 2 p.m
2 Bristol S.M.E.E. Public running at Ashton Court Track. 11 a.m. to 6 p.m
2 Cannock Chase M.E.S. Steam Up Cannock Park 2 p.m
2 Guildford M.E.S. Running day for members at H.Q. Stoke Park.
2 Malden & District S.M.E. Open day 2.30 to 5 p.m
2 Rugby M.E.S. Members running day.
3 City of Leeds S.M.E.E. An evening with Mr Tait
3 Worthing & District S.M.E. Power Boats. Mr. L. Lasseter Broadwater Parish Room 7.30 p.m
4 Taunton M.E.S. A.G.M. and Prize giving Taunton Rugby Comm. Rooms. 7.30 p.m.
4 S. Cheshire M.E.S. Bits and pieces. Victoria Hotel, Crewe 7.45 p.m
5 Cannock Chase M.E.S. Meeting Cannock Park 7.30 p.m
5 Harrow & Wembley S.M.E. Committee
5 Portsmouth M.E.S. Gen. meeting at Y.M.C.A. 7.30 p.m
5/6 Southampton & District S.M.E. Southampton show staging
6 High Wycombe M.E. Club monthly meeting at Basselsbury Manor 7.30 p.m
6 N. Devon S.M.E. Talk on Lapidary by Mr Irvine
6 Leyland, Preston & District S.M.E. Meeting at Roebuck Hotel, Leyland, at 8 p.m
7/8/9 Southampton & District S.M.E. Southampton Show
8 Hull S.M.E. Exhibition of B.P. gala at Sal-[illegible]
8 Gauge O Guild. Meeting at St. Johns Parish Church Hall, Cauldwell Hall Road, Ipswich from 2 to 6 p.m. Running track will be available
8 Milton Keynes M.S. Model boating display Towcester Round Table, Towcester, Northants 3 p.m
8/9 Chesterfield & District M.E.S. Steam days. Papplewick Pumping Station.
8/9 Isle of Wight M.E.S. Broadfields, Cowes At Home
9 Harlington Loco Soc. Public open day High Street, Harlington, Middx. 2 to 6 p.m

Post Bag

The Editor welcomes letters for these columns. Pictures, especially of models, are also welcomed. Letters may be condensed or edited.

Drop Valves

SIR,—We were interested to read the article "A Model Cross Compound Mill Engine" by Alan Haworth (*M.E.*, 6 January 1978).

Corliss valves were not immediately accepted with enthusiasm by English builders, as although firms such as Hick, Hargreaves did take them up, many did not, for the simple reason that customers would not pay the extra money, or risk the higher possibility of breakdown of the more complex gear. Pollit and Wigzell for example, the largest of the Yorkshire engine builders, did not take Corliss gear up until c. 1890.

Steam inlet valves on mill engines were not always "of necessity of the double beat type" and the exhaust valves were not eventually replaced by Corliss valves as he seems to suggest.

As far as the major Yorkshire mill engine builders were concerned, most used the piston drop valve. We have only come across a few instances of a Yorkshire mill engine builder using double beat drop valves on a modern engine. The piston drop valve should not be confused with the double beat drop valves, which dropped on to ground seats to cut off steam. This drop had to be cushioned very accurately, and had to be arrested within a few thousandths of an inch, or it would hammer, destroying its seat and losing its steam tightness. The piston drop valve on the other hand worked in a ported liner, and was much quieter and easier to keep steam tight. Those who have seen a piston drop valve engine running, will have been impressed by its quietness.

The pioneers in the use of piston drop valves in Yorkshire were Cole, Marchent and Morley, who from 1903 built well over 100 engines with this type of valve (Morley's patent), but were the only Yorkshire engine builder to adopt them exclusively. Piston drop valves were used for both steam and exhaust, and they never used Corliss exhausts, unlike their Calder valley counterparts, Pollit and Wigzell, who built all their drop valve engines with piston drop inlet valves and Corliss exhausts.

Up the road from Cole, Marchent and Morley, at Dudley Hill, Newton, Bean and Mitchell again used piston drop valves for both steam and exhaust on all their drop valve engines, but in some cases fitted horizontal exhaust valves to keep the gear above floor level.

What should be made clear is that drop valves never took over the English market, and were always much in a minority.

The use of Edwards air pumps, either driven from the tailslide or from the crosshead, were far from being unusual. Quite a number were used by a large variety of builders, both for horizontal and vertical engines, as well as being used in independent condensing plants. Around 1905, Cole, Marchent and Morley were paying royalties to the Edwards Air Pump Syndicate of one shilling per inch of air pump bucket diameter.

Thank you Mr. Haworth for your articles on mill engines, very little is written about them in *Model Engineer*. Perhaps if mill engines ran on wheels, there would be more interest in them. It was interesting to see the photographs of the excellent piece of Belgian engine building, obviously not now running, but typical of many engines imported to satisfy the British demand after the turn of the century.

Thornton, Bradford. P. D. Lodge, B. Kershaw

Alan Haworth Replies

SIR,—*I agree almost entirely with the comments made. I am well aware of the differences between the double beat drop valve and the piston drop valve, and in my opinion the two are incomparable. I have seen, and worked on, many PDVs and as you state, they are delightfully quiet. As you remark, engines with mixed valves, i.e. drop valve and Corliss, were not in a majority, but then, neither were they a rarity. The reason I chose this particular configuration was to provide an interest to the average model engineer not generally to be found in other engines. One has, so to speak, the joy (?) of both valves in a single cylinder. I do not compare the merits, or otherwise, of either type. Personally I am by choice a "Corliss" man. However, "man does not live by bread alone".*

With regard to condensers and air pumps, perhaps the use of the word "unusual" was an unhappy choice of phrase, in so far that what I intended to convey was that many, many engines had air-pumps driven from the LP crosshead. Also there were many air-pumps with "splash-type" buckets and headers, i.e. non-"Edwards" type. I am happy to note that you registered the fact that drop valves were always in a minority. The engine shown in the photos was indeed a Carels Freres of Ghent, Belgium, and was unusual *in so far that she was fitted with a surface condenser and a motor-driven extraction pump. Might I express my thanks to you both for the interest you have shown in the above? The Belgian engine was running until 1973, and ran almost night and day during war-time in a corn mill.*

Barrow, Cumbria. *Alan Haworth*

Crank Pin

SIR, — Reading Mr. Gordon Hobson's letter, *M.E.*, Vol. 144, April 1978 issue, I was surprised to see in his sketch a crank pin with a flange against the web of the crank. I was taught that this was not good engineering practice, as it was virtually impossible to stop the flange or shoulder pulling away from the web face during shrinkage. This caused the edge of the web to bite into the pin, and often caused hairline cracking.

All large steam engines I worked on always had plain pins, and if the crankshaft was built up, the section on which the web was shrunk was also plain. The round peg was driven in before shrinkage of the web took place. I believe that this was also the method used for shrinking on the driving wheels of steam railway locomotives.

Calne. Martin Spearey

Hackworth Locos

SIR, — I wonder, can any reader give me information regarding the names of the 25 six-coupled locomotives built by Timothy Hackworth for the Stockton & Darlington Railway about 1838 onwards. The first, I believe, was named "Royal George" No. 1 and the next was "Derwent" No. 25. I should be extremely grateful if I can ascertain the name of No. 10.

Chester. E. E. Hobson

Horizontal Engine

SIR, — In the fullness of time I have planned that all my available stationary steam engine models should be permanently accessible as a collection. A few earlier models of mediocre interest were disposed of. The power plant of my steam tug (1953) is now in a stern wheel paddler in California and another marine engine reached the Canary Isles after first going to a London dealer.

One engine which I could possibly buy back was illustrated in a rather mediocre reproduction on page 577, *M.E.* No. 2863, 5 April 1956. This model, a single-cylinder horizontal, 1½ in. x 2¼ in. cylinder, fitted with reversing gear, was sold to an unremembered gentleman in Winnipeg, Canada, circa 1957.

I would therefore be most grateful to receive any correspondence via *M.E.* offices, which could give me a lead to the present location of this engine.

In the future circumstances I describe, it may well be that helpful chords will be struck in some distant place!

King's Lynn. A. Beaumont

Unknown Lathe

SIR, — Could you help me with a lathe bed that I found recently? It has been a screw-cutting centre lathe and cast into the bed are the letters A.2. Also it is stamped with the serial no. R. 1353 or 1363 — middle number is not clear. I would like to restore this if I could find the parts to it; it has the headstock and compound slide missing. Perhaps you could let me know if you know what the make is.

Bournemouth, Hants. P. J. Hull

Professional Turning

SIR, — As a professional turner of some 45 years at the "trade" and still so engaged, I take exception to the offhand way Mr. Geo. Thomas dismissed our skills by his statement (*M.E.* No. 3572, p. 1220) that "we are not expected to work much closer than about plus 5 or 10 thousands of an inch".

What utter rot! Tradesmen turners could do better than that with a knife and fork, besides 5 to 10 thousands of an inch doesn't leave sufficient metal for grinding. Twenty to thirty thousands of an inch would be more like it.

Realistically, there is no substitute for a lathe and experience and I may say quite categorically that 99 per cent of the work done by tradesmen on a lathe would be impossible to grind. Bolts indeed! And on a centreless grinder? Mr. Thomas shows a complete ignorance of grinding to even suggest such a ridiculous and hazardous operation. It just can't be done.

That is unless the bolt heads were first sawn off.

For a magazine that purports to instruct the amateur I should hope that those of your staff who compile the technical articles might hold better qualifications than Mr. Thomas appears to have.

Cabramatta 2166, N.S.W., Australia.

Alexander P. Russell

George Thomas Replies

It is a pity that Mr. Russell has taken umbrage at my remarks on turning which were not intended to, nor do they, belittle the "tradesmen turners" of today. There was no suggestion that turners in general were incapable of working to fine limits but only that – to quote – "fine-limit work can be done far more readily and cheaply by transferring the job to a grinder", which is correct in spite of anything that Mr. Russell might think to the contrary. Perhaps forty-five years is too long to be a centre-lathe turner. As for doing better with a knife and fork – I don't know – but I have met some self-styled tradesmen turners whose work led me to imagine that they had a set of false teeth in their tool kit!

Whether or not 5 to 10 thous is a sufficient allowance for grinding must obviously depend on the size and nature of the job. Perhaps Mr. Russell has been engaged all his life on large work while my experience has been with mainly medium to small on which grinding allowances were often .007 in. on diameters and .003 in. on faces.

I would certainly never claim to be an expert on grinding practice but Mr. Russell has made it clear that his knowledge of the subject is less than mine. Of course it is possible to grind bolts on a centre-less grinder. Mr. Russell appears to be under the impression that these machines will handle only "through-feed" work (such as precision ground bars) whereas there are two other main ways in which they can be used, namely: end-feed grinding up to a stop and "plunge" (or "infeed") grinding which is used in the daily production of millions of small items from H.T. bolts (complete with heads!) to the M.T. shanks on drills. This method of grinding is capable of working to limits of .0001 in. diameter.

I would remind Mr. Russell that many items have to be ground in order to comply with "surface finish" requirements which could not be met by turning and, in conclusion, I think that he would be well advised to look around him and make sure of his facts before making such disparaging remarks as are contained in his letter.

Geo. H. Thomas

Power Hacksaw

SIR,—With reference to the article on "A Power Driven Hacksaw" (*M.E.*, July 1977, page 819), by J. H. S. Young, this shows two 53T wheels meshing together, one of which is connected by a shaft to a 20T wheel and this in turn meshes with a 95T wheel. As shown on the drawings, the two 53T wheels are on the same centres as the 20T and 95T wheels at a centre distance of 2⅞ in.

As all the gear wheels used were Myford change wheels they are presumably all the same diametral pitch. If this is the case then the centre distances cannot be the same, as you will see from my calculations.

$$\text{PCD} = \frac{N}{DP} \quad \text{for 53T wheel DP} = \frac{53}{2.875} = 18.43 \text{ in.}$$

$$\text{for 20T PCD} = \frac{20}{18.434} = 1.085 \text{ in.}$$

$$\text{for 95T PCD} = \frac{95}{18.434} = 5.153 \text{ in.}$$

$$\text{Centre distance} = \frac{5.153 + 1.085}{2} = 3.119 \text{ in.}$$

If the 20T wheel is to be retained then an 86T wheel will be required, as is shown below, to maintain the 2.875 in. centres.

$$\text{for 86T PDC} = \frac{86}{18.434} = 4.665 \text{ in.}$$

$$\text{Centre distance} = \frac{4.665 + 1.085}{2} = 2.875 \text{ in.}$$

As I have decided to make a hacksaw based on Mr. Young's design and will be using Myford gears, I shall be using a 21T and an 85T change wheels as Myford do not do an 86T wheel. Incidentally, the number of strokes will change from approximately 90 (115 in actual fact) to 135 strokes per minute if the same motor and pulleys are used.

I hope the above is of some use to anyone else who is considering adding this useful tool to his workshop collection.

Leeds. David Place

Tether Racing

SIR, — It was nice to read again about the old r.t.p. and rail racing cars. However, I am afraid that, as regards rail racing in England, the picture given by Tony Higgins' article is misleading.

Firstly, in this country rail racing (I.C. racing, that is) started considerably later and flourished much longer than he suggests. Secondly, there were here none of the expensive and permanent raildromes that he describes. Our tracks were light, portable and cheap. Finally, the rail racing rules of both the M.C.A. and the M.R.C.A. imposed a maximum capacity limit of 1½ cc. — not the 10 cc. he refers to.

The first rail track (for I.C. cars) in England was built in 1948/9 by a body of enthusiasts, largely from the Pioneer Club, who called themselves "The Raildromers". This was followed a few months later by a track (Nordrome) built by my own club, The North London S.M.E. A number of tracks followed, in various places, and at the Model Engineer Exhibition of 1953 Rex Hays had a track on show, on which in fact several North London members ran.

Up to that time, there had been no attempt to standardise the rails, etc. In 1952-3 Henri Baigent evolved a system which used a 5/16 in. round rail with roller guides or "zonkers". This simple and effective plan at once proved popular and a patent in respect of it was granted in 1954 to a company — M.R.R.C. Limited.

The company, as patentees, required that all users of the system in future should use the company's fittings. While it must be a matter of speculation, my own opinion is that the necessity of buying fittings that could easily be made, and the fact that a separate Association — The Model Rail Car Association (M.R.C.A.) was formed for users of the system, discouraged many clubs from taking part in the sport. Nevertheless, for a number of years, the hobby prospered very much; there being a regular "circuit" of some six major meetings each summer, on the results of which the championship was decided.

However, with the mid-'sixties, the hobby slowly declined, partly arising out of the difficulty of finding track sites where noise would not be a nuisance and partly owing to the rival attractions of, first, electric rail (and slot) racing, and then of radio control — both of which gave more scope for personal skill and control. Further, as time went on, the tracks began to require substantial rebuilding, a major job that usually fell on a comparatively small number, while the less keen drifted away.

As a result, the number of active clubs began to decrease till, by 1967, to my knowledge only North London and Portsmouth continued to operate. North London continued to run — though well diminished — for a year or two. Then, the garage where we had long run being no longer available, it was decided, regretfully, to discontinue running. Since then, of course, the club has on four occasions won the National Team Championship for electric racing, but diesel car running has not been resumed.

London W.1. T. W. Pinnock

Rack Railways

SIR, — Do you or your readers know of any work on 5 in. gauge rack railways? I have a sloping garden and inclines would be 1 in 5, although steeper sections are possible.

If anyone has information, advice or equipment I would like to contact them, particularly on questions of racking, gearing, engage/disengage mechanisms for mixed level/inclined tracks and safety.

Although steam power is the prime interest, electric truck drives are also envisaged for workhorse use. I am considering dual gauge 5 in./10¼ in., the larger gauge for passenger carrying at ground level for the trucks only.

Any information on similar work in other gauges such as 1¾ in. would also be of interest.

Malvern Wells, Worcs. G. Bishop

Drummond Lathe

SIR,—Referring to the letter (4/11/77) from Mr. W. Melville, I am afraid that my comments on the design of the 3½ in. Drummond lathe were, perhaps, rather severe but I know that many other owners of these lathes would agree with me. It was not until some years after I had owned one that the reason for the rather skimpy mandrel dawned on me. Heaven knows I expended enough energy in treadling, especially as, in order to reduce chatter, I kept the bearings fairly tight—I should have looked at my tools! I rarely used the two larger steps on the flywheel except for use with back-gear; most of my turning seems to have been done with the belt on the small (about 11 in.) step. I do think, however, that in later years when electric drive became more the rule rather than the exception, some re-design of the headstock would have been justified.

Incidentally, I came across the first announcement of this lathe in the *M.E.* for July 1903 (Vol. 9, p. 95) only this week-end. It was a most unprepossessing looking affair in those days but there is no doubt that it played a most important part in the development of our hobby.

In the same volume I came across references to a new constructional outfit called "Mechanics made easy" which was manufactured by Messrs. Elliott & Hornby of Liverpool. This was the first Meccano outfit. My Christmas present in 1912 was a No. 1 outfit costing, I think, 5s. (though it might have been 2s. 6d.). Numbers then ran from 1 to 6 with supplementary sets 1a, 2a, etc. in between. These were used to upgrade from one number to the next. By 1914 mine had been made into a No. 4 plus, all contained in a large wooden case with lift-out trays, which had been made specially for it. By 1938 I did the same for my son and his very large outfit is now being used (or abused) by my grandchildren in New Zealand. The letter designations mentioned by Mr. A. V. Smith were not used in the earliest days.

The introduction of a new motor-cycle by Messrs. John A. Prestwich (J.A.P.) of Tottenham was announced on page 14 (9 July 1903); altogether an interesting volume.

New Milton, Hants. Geo. H. Thomas

Removing Paint

SIR,—The restoration of old machinery generally requires the preliminary removal of paint, gunk and baked-on grime. In my hobby of rebuilding "hopper-cooled" gasoline engines, I have found the following recipe most effective.

To a pail (neither plastic nor galvanized) containing about a gallon of water, add about a cupful of cornstarch (which you probably call maize-powder or something equally stately). Mix well. Then add a pound of pure lye. Stir well. The mixture will form a glop which will cling to vertical surfaces. Apply with a nylon paint brush. Do not use on zinc, including white-metal die-castings, nor on aluminium.

The jelly-like material will not harm iron or steel, in fact is seems to prevent rusting. It may be removed after a few hours or days with a forcible stream of water, and re-applied as necessary. Be sure to wear rubber gloves, or use a long-handled brush. If it gets on the skin, water will remove it readily. Prudence requires wearing goggles.

Purists will neutralise the cleaned surface with ordinary vinegar, but this is probably unnecessary.

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Cleaning Morse Taper Sockets

SIR,—The importance of keeping morse taper sockets perfectly clean cannot be overstressed but how many tapers only ever receive an occasional poke out with the little finger before putting in the drill chuck or centre? A simple method is to turn up a wooden taper plug and glue three strips of soft leather equi-spaced along its length. The diameter of the taper should allow for the thickness of the leather used for the strips which should be about 3/16 in. wide and glued with the rough side outermost. Next time the top slide is set at the appropriate angle for the lathe taper, lop off a length of broomstick and make up this simple tool. It is advisable to take the workshop broom handle to avoid domestic strife!

You will probably be amazed at the minute particles of metal which quickly appear embedded in the leather strips after the tool has been used a few times. The particles should be scraped out as much as possible and the leather strips replaced from time to time.

Bellach. D. F. Pratt

Efficiency by Design

SIR,—I read the above article in your 6-19 January issue of *M.E.* by Mr. Wingrove with interest.

Every person has his own ideas regarding what he requires in the way of tools, equipment and atmosphere to work in but I am rather surprised to read about the lengths he has gone to to hide the machinery which he was to earn his living with, as it were. This must give him extra work opening special cupboards and lifting shutters, etc., each time he works.

Although I pride myself on being a very methodical and tidy worker I have always found that model engineering is really quite a messy business and the quantity of cuttings which deposit themselves on the floor during a machining operation does not make the workshop suitable for having carpets. If he engages in frequent machining I would be interested to know by what method he manages to keep his carpet clean. Judging by the photographs in the article, he has built quite a number of very nice models on what I would say is rather limited equipment. His main items being the milling machine and two lathes. I should have thought that the requirement for earning one's living professionally at the calling would be quite a wide range of basic equipment. This he does not seem to have.

I would also be interested to know what type of construction and heating he used.

Edinburgh. S. W. Blackley

Meccano

SIR,—Reference Mr. A. V. Smith's letter "Meccano", 4-17 November, it would appear that both Mr. Smith and Martin Cleeve are correct.

I have a copy of the "Army & Navy" catalogue for 1935/6 and in it are listed two kinds of Meccano outfits—one called Red/Green runs from size 00 to No. 7, that is 3s. 6d. to 450s.; the other kit is Blue/Gold and runs from A to L, priced at 5s. to 410s., the last two sets of each being in cabinets, and no VAT!

Weybridge, Surrey. E. J. Bright

3½ in. gauge "Betty" 2-6-2

SIR,—I am about to start building the 3½ in. gauge *Betty* 2-6-2 Southern M2 class tender locomotive. So far, however, I have not been able to locate a copy of LBSC's construction manual. As a last resort I wonder if any reader has a copy. If so, I would willingly recompense any owner willing to part with his manual whatever its condition.

Pewsey, Wiltshire. John Jenkins

Murdock Aitken Steeple Engine

SIR,—Can anyone please supply me with information regarding the "Murdock Aitken" Steeple Engine?

1) What was the original colour scheme? Detailed if possible.
2) Was the cylinder cladded and if so, would wood cladding be appropriate?
3) Could you give me a short history or background?
4) Was this engine fitted with cylinder drain cocks, if so, where did the drain pipes run?
5) What was the purpose of the square on the end of the main drive shaft?

Mansfield, Notts. Alan E. Booth

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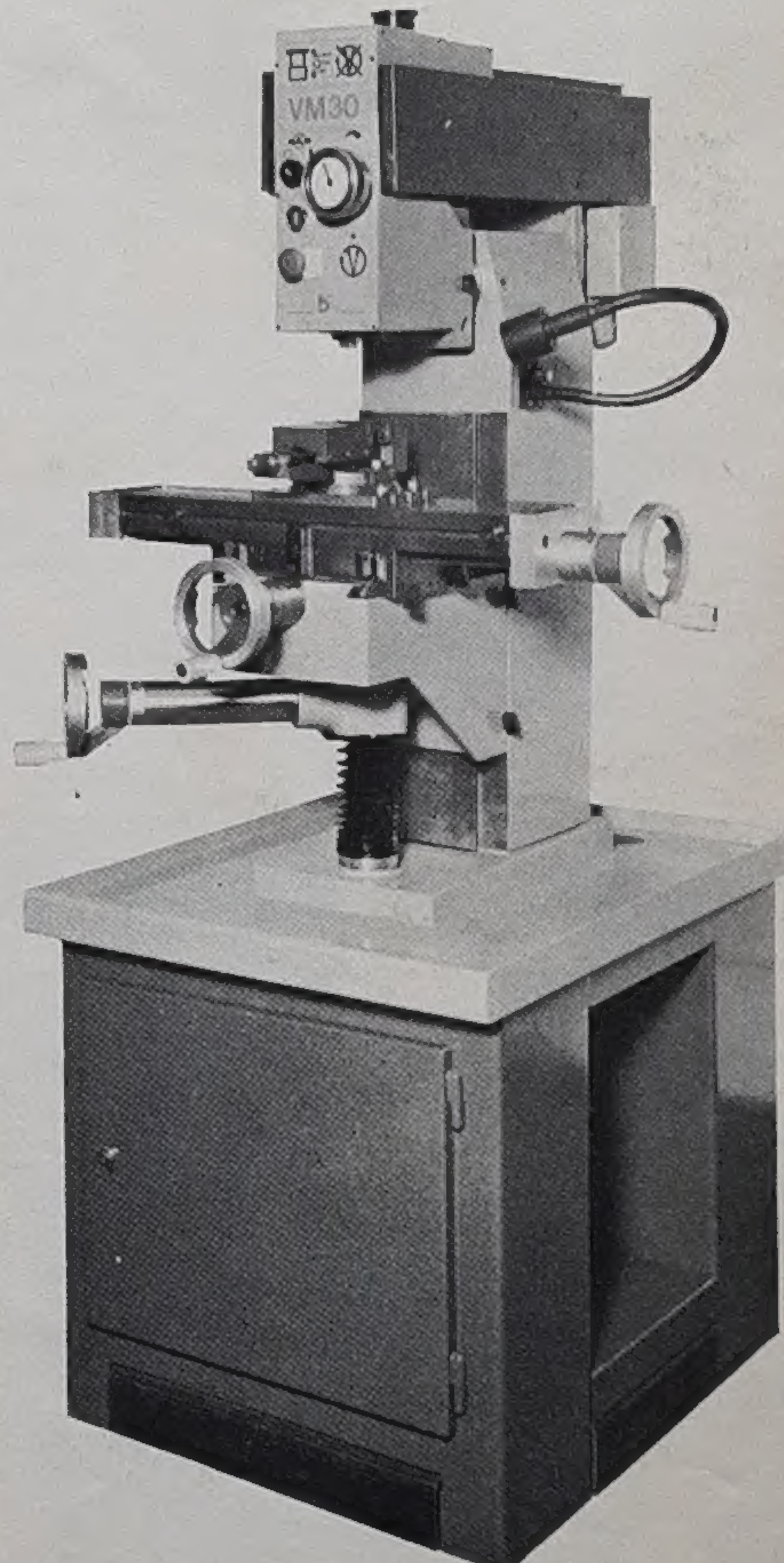

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